

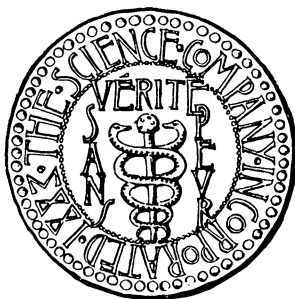
SCIENCE

AN ILLUSTRATED JOURNAL

PUBLISHED WEEKLY

VOLUME I

FEBRUARY—JUNE 1883



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Vérité sans peur.

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FRIDAY, FEBRUARY 9, 1883.

THE FUTURE OF AMERICAN SCIENCE.

THE progress of science in any age is determined largely by the circumstances of its environment. The soil in which it is rooted, the atmosphere from which it draws the materials of its life, and the stimulus of light and heat which it receives, all have a strong determining influence upon its growth. Nowhere, probably, has this influence of the surroundings been more potent than in our own land. The intense activity of our people, the high intellectual, commercial, and social pressure under which they live, their enthusiastic interest in scientific knowledge and the generous liberality with which they foster it, — all these agencies have had a powerful influence in creating the position which American science assumes to-day. We may not, indeed, boast of a scientific record as full and complete as that of other countries; but we may and should take an honest pride in the achievements in pure science which we have already actually accomplished. The names of Agassiz and of Peirce, of Bache, Henry, and Draper, of Hare and Silliman, of Bond, Watson, and Chauvenet, of Rittenhouse and Saxton, of Rogers, Hitchcock, and Cleaveland, are worthy to be enrolled high up in the temple of scientific fame. The work done by these men in the direction of original research will ever stand the test of time, and will always keep their memories green.

The leading feature of American science, however, and that which most distinctively characterizes it, is its utilitarianism. True, there are in our country able investigators working in scientific fields which do not offer the promise of material reward; but notwith-

standing this, it remains still true that those sciences whose principles are capable of useful application are the most zealously cultivated among us, and attract the largest number of students. Nor is this to be at all regretted. Research is none the less genuine, investigation none the less worthy, because the truth it discovers is utilizable for the benefit of mankind. Granting, even, that the discovery of truth for its own sake is a nobler pursuit, because a less purely selfish one; does it become any the less noble when it is ascertained that the truth thus discovered is capable of important applications which increase tenfold the happiness of human life? It may readily be conceded that the man who discovers nothing himself, but only applies to useful purposes the principles which others have discovered, stands upon a lower plane than the investigator. But when the investigator becomes himself the utilizer; when the same mind that made the discovery contrives also the machine by which it is applied to useful purposes, — the combined achievement must be ranked as superior to either of its separate results.

The inventive genius of this country is pre-eminent. We reap the benefits of it on every side. Our houses are more comfortable, our railways more safe, our fabrics cheaper, and our education more thorough, because of useful inventions. Becoming restive at the slow progress of discovery, the inventor has himself assumed the rôle of investigator; and the results of his researches appear in the records of the patent-office. In the olden times the investigator was content to make his discoveries, and to publish them, consecrating to science the knowledge thus obtained. His more modern representative carefully treasures what he has discovered, until he has exhausted its practical applications. In consequence, the

discoveries upon which many of the most important scientific inventions of the day rest, will be searched for in vain in scientific literature. The telegraph, the telephone, and the electric light are inventions which illustrate the fact now stated, in an eminent degree.

Another direction in which applied science has been developed in this country is found in the work done by the various government organizations. Is the weather-probability an important factor in the citizens' welfare? Immediately the signal service of the army is developed into a complete meteorological organization to collect data, and deduce forecasts. Is navigation to be made more safe, and internal boundaries more accurate? The coast and geodetic survey is created to carry on the most refined investigations upon standards of measure, and the various methods of applying them. Is the fishery question an important one to our commercial interests? A fish commission is organized, and under its direction the most elaborate investigations in vertebrate and invertebrate zoölogy are undertaken. Are the mineral lands of the government to be reported on? Geological surveys are commissioned to explore the public domain, and are clothed with ample power to make their work elaborate and exhaustive, and to embody their results in extended reports, not alone on the economic side, but including all the collateral branches of science. Is a knowledge of the properties of iron and steel of essential value in constructive engineering? Forthwith a special commission appears, charged with authority to execute the most refined chemical analyses and the most delicate physical tests upon these metals. Is there danger to agricultural interests from the depredation of insects? An entomological commission is appointed by Congress, with instructions to exhaust the resources of science for the protection of the crops. Moreover, besides the work done in this way, special investigations are always in progress under the direction of the departments; more especially those of war, of the navy, of the treasury, and of the interior; the services of the

engineer-corps, in river and harbor improvements, for example, it is not easy to over-estimate. In the end, it is true, these investigations have a practical object; but to attain this, in many cases, theoretical results are reached which are of the highest value to pure science.

It is no wonder, then, that, in the midst of such kindly appreciation by the intelligent and educated masses of our people, — an appreciation manifested alike by personal munificence and by governmental appropriation, — all the sciences, but especially those which reward appreciation by practical benefits, should have attained their present satisfactory development. Who can say to how large an extent the eminent position of practical astronomy in America is due to the unrivalled telescopes of Alvan Clark? The wonderful microscopic photographs of Woodward have been made possible only by the perfection to which Tolles has brought his object-glasses. The bolometer of Langley has given us new conceptions of sunlight; and the exquisite gratings of Rowland promise to do still greater things for us, in the same direction. In the experimental sciences especially, their unexampled advance is a continual testimony to the abundant return which practice has made for the benefits it has received from theory.

While the scientific cynic may condemn the utilitarianism of our age, the more liberal man rejoices in it, since science is thereby the more advanced. He is thankful that the people view these scientific questions with the broadest liberalism; that they are not disposed to confine scientific inquiry to those investigations alone whose results are practical, but pour out their substance freely in aid of scientific work in all directions, theoretical as well as practical, pure as well as applied. This generous disposition toward scientific research, so characteristic of this country, has called forth unreserved commendation in Europe. The munificence of the gifts which have been made to science, both public and private, the liberality with which research has been endowed in America, have been the astonishment of

men of science in other countries. Such is the environment in which American science has been developed; such the favoring soil, atmosphere, and warmth with which it has thus far accomplished its growth.

Under such conditions, it is not difficult to foresee a brilliant future for American science. Scientific evolution, like the evolution of a species, requires complete conformity to the conditions of existence. The science of to-day is in thorough accord with the spirit of the American people. They are proud of every achievement it makes, and are satisfied with the returns it is giving them for their investments. To continue this *entente cordiale*, should be the object of every scientific worker. He may the more readily concede some practical return for the facilities for investigation which the people have furnished; since the march of discovery is not in the least hindered, but rather promoted, by the practical application of the new truth it develops. His attitude toward invention should be appreciative and cordial. He should cast aside all prejudice against the man of patents and practical devices, and should stand ready to welcome the investigator in whatever garb he appears.

But more than this. Science must be true to itself as well as in accord with its surroundings. It must maintain ever the highest tone and the most impartial accuracy. It must covet the scrutiny of every eye, and must be generous ever in the acknowledgment of its shortcomings. Higher than all, it must be devoted to the truth. It must cheerfully undertake the severest labor to secure it, and must deem no sacrifice too great in order to preserve it. It must have an unlimited capacity for work, and an unlimited enthusiasm in it, while at the same time a proper reserve in affirming the results of it. While striving itself for the highest attainable accuracy, it must be catholic and liberal toward others. It must not magnify differences, nor impute motives. It must be ready to adjust, with the utmost patience, conclusions which are apparently discordant. It must treat all questions with fairness and candor. When it ventures

nearest the boundaries of knowledge, it should assert itself cautiously. In its relations with other departments of knowledge, it must preserve toward them a due consideration. It must venture upon prediction with circumspection. It must take care, on the one hand, not to set too narrow limits to the possibilities of discovery; on the other, it must be quick to discern the directions of advance, and to utilize the smallest suggestion to promote discovery. It must be fruitful in working hypotheses, but it must test these with unsparing rigor before it offers them as a part of established truth.

Moreover, in order that it may advance beyond the boundaries of present knowledge, it must keep fully and constantly informed of the position of the ever-varying line which marks the limits of the known. It must have and use all the publications in which are recorded the work done by others in all the various fields of research. It must not waste its energies in doing again what has already been well done. Beginning its work where others have left off, it must carry out into the misty region of hypothesis the most complete methods known for the solution of the problems it has attacked. Not contented alone with receiving the work of others, it must furnish its methods and results for publication, thus contributing its part to the interchange and discussion of opinions by which discoveries finally become an integral part of truth. It must recognize the importance of making the scientific literature of the day the repository of scientific progress; so that every advance, whether of theoretic or applied science, may find a record in its pages.

The year 1883 opens auspiciously. The scientific sky is clear, and the outlook promising. If true to itself and to its surroundings, American science has nothing to fear from the future. With the increase of a generous people, and the spread of intelligent scientific thought, it has every thing to hope. Under these favorable circumstances, SCIENCE enters upon its career. May it early recognize the conditions of this certain progress, and ever be on the alert to help it forward.

PHOTOGRAPHING THE CORONA WITHOUT AN ECLIPSE.

PERHAPS the most important observation since the discovery by Janssen and Lockyer that the solar chromosphere could be studied without an eclipse, has recently been made by Mr. Huggins,¹ the well-known English astronomer.

When the spectroscope had been found capable of bringing this important region into daily view, there still remained the corona, whose feeble light and nearly continuous spectrum defied all attempts to see it through the overpowering glare of our own atmosphere; which, even in the purest sky, acts as a luminous veil between us and the object. It is very easy at all times to cut off the sun's direct light by a screen: unless the screen be at an enormous distance from the eye, however, this glare is not diminished by its use. Mr. Huggins's method is founded principally on two considerations.

The first is, that the principal coronal radiation (as found in Egypt by Dr. Schuster in the late eclipse) occupies a narrow part of the spectrum between G and H, while the atmospheric glare consists of light of all refrangibilities. As this coronal radiation, though occupying narrow limits of wavelength, is not monochromatic in the sense in which that of the chromosphere is, he has not employed the prism to disperse the atmospheric glare, but certain absorbent media to shut it out; choosing those, of course, most transparent to this violet light alone. The best isolating medium has been thus far found to be potassic permanganate.

The second consideration is, that since the G—H region is near the limit of vision, where, though the retina responds but feebly, the photographic plate is active; and since the latter is sensitive to feeble distinctions of light, and preserves a permanent record of them, it is best to use it, rather than the eye. Dr. Huggins has worked with a Newtonian telescope having a mirror of six inches aperture and three and one-half feet focus. By selecting fine days, he has obtained, between last June and September, twenty plates, showing what appear to be the rays and streamers of the sun's inner corona.

As at least one European observer of distinction deceived himself by the supposition that he had obtained a naked-eye view of the corona without an eclipse, and as the appearances about the sun caused by inequalities in

¹ On a method of photographing the solar corona without an eclipse. Paper read at the Royal society by William Huggins, D.C.L., LL.D., F.R.S., Dec. 21.

our own atmosphere are most perplexing, and so corona-like as almost to 'deceive the very elect,' the reader will be interested in perusing the following letter to Mr. Huggins from Captain Abney, the eminent photographer:—

"A careful examination of your series of sun-photographs, taken with absorbing media, convinces me that your claim to having secured photographs of the corona with an uneclipsed sun is fully established. A comparison of your photographs with those obtained during the eclipse which took place in May last shows not only that the general features are the same, but also that details, such as rifts and streamers, have the same position and form. If in your case the coronal appearances be due to instrumental causes, I take it that the eclipse photographs are equally untrustworthy, and that my lens and your reflector have the same optical defects. I think that evidence by means of photography, of the existence of a corona at all, is as clearly shown in the one case as in the other."

This is a clear opinion from a master of the subject; but Dr. Huggins's own caution in statement, as well as skill in research, are, without it, sufficient to predispose us to believe, that, in spite of its difficulties, the problem of securing the forms of the inner corona without an eclipse has been, in principle, solved. What these difficulties are, only those few who have experimented in this particular direction know. As one of this number, the writer can only express his sense of the great consequence of the result reached, and his admiration of the skill employed in obtaining it. It is given to few to crown such a scientific life as that of Dr. Huggins, by a discovery of such importance.

S. P. LANGLEY.

A SINGULAR METEORIC PHENOMENON.

WE are indebted to the favor of the Bureau of Navigation, for the privilege of publishing the following very interesting letter of Captain Belknap, addressed to Commodore John G. Walker, United-States Navy, Chief of Bureau of Navigation, Navy Department, Washington.

U. S. S. ALASKA, AT SEA,
lat. 37° 54' N., long. 124° 25' W.
Dec. 15, 1882.

SIR,—I beg to report, that on the evening of the 12th inst., a few minutes after sunset, and in lat. 38° 21' N., long. 134° 07' W., a remarkable phenomenon was witnessed in the western horizon from the deck of this ship.

The sun had set clear, leaving the lower sky streaked with gorgeous tints of green and red, while the new moon, three days old, gave out a peculiar red light of singular brilliancy. Suddenly, at three minutes before five o'clock, a loud rushing noise was heard, like that of a large rocket descending from the zenith with immense force and velocity. It was a meteor, of course; and when within some 10° of the horizon it exploded with great noise and flame, the glowing fragments streaming down into the sea like huge sparks and sprays of fire.



FIG. 1. — Directly after explosion.

Then came the most wonderful part of the phenomenon; for, at the point in the heavens where the meteor burst, there appeared a figure like the shape of an immense distaff, all aglow with a bluish-white light of the most intense brilliancy. It kept that form for perhaps two minutes, when it began to lengthen upwards, and grow wavy and zigzag in outline from the action of the wind, and gradually diminishing in breadth, until it be-



FIG. 2. — From 2 to 3 minutes after explosion.

came a fine, faint spiral line, at its upper end dissolving into the fast-gathering clouds the meteor seemed to have evoked. It so remained, a gorgeous scroll of light, emblazoning an arc of some 15° or 20° in the heavens, and with all its vividness and brilliancy of coloring, for ten minutes longer, when it began to fade, and finally disappeared at eleven minutes past five o'clock, apparent time. So grand and startling had been the effect produced, that it might have been likened to a thunderbolt and its trail indelibly engraved upon the sky. All on board gathered on deck to look at the wonderful phenomenon, and all said they had never seen so marvellous a sight before. Had the meteor struck the ship, it would doubtless have been the last of the *Alaska*, and no vestige would have been left to tell the tale of her loss.

And to those who witnessed this strange and unwonted manifestation of the forces of the universe comes the suggestion of possible unthought-of cause of sometime disasters at sea.

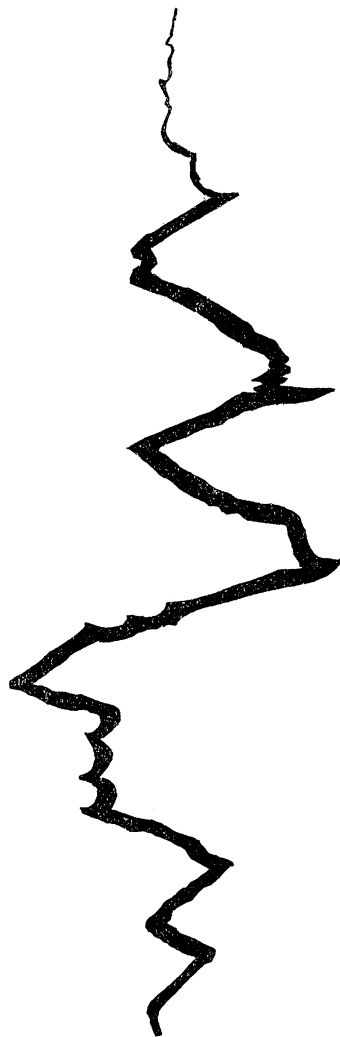


FIG. 3. — At 5.09 P.M.

I beg to enclose sketches giving a faint idea of a portion of the phenomena described above.

Very respectfully, your obedient servant,

GEO. E. BELKNAP,

Captain U. S. N., Commanding.

[On the evening of June 29, 1860, when encamped at the mouth of the Red River, on the southern shore of Lake Winnipeg, the astronomical party, sent that year by the Nautical almanac office to observe, July 18, on the

Saskatchewan, the eclipse of the sun, saw a meteor flash in the northern sky, the trail of which remained visible near the horizon for about three-quarters of an hour, taking on a form somewhat resembling the later ones depicted by Captain Belknap, and in that time changing its position considerably, both relative and absolute.]

THE TYPHOON AT MANILA, PHILIPPINE ISLANDS, OCT. 20, 1882.

THE accompanying diagram gives an abstract of the curves traced by the meteorological instruments at the observatory in Manila, Philippine Islands, during the typhoon which swept over the central provinces of Luzon, Oct. 20, 1882, from the time when the first indications were noticed at the south-east of Manila, at noon of the 19th. The observers were the Jesuit Fathers under Padre Faura, and the instruments those once used by Father Secchi at Rome. Observations made at the marine and telegraph offices in the city, and on the national war vessels on the coast, are incorporated in the diagram.

Barometer.—The mercury descended at noon of the 19th to 756 mm. (about $29\frac{1}{2}$); varying little till near midnight (19–20th), when it began to go down more rapidly. It has been noticed, that, when it descends to this point in the Philippine Archipelago, it always indicates a storm at a considerable distance. Up to dark there had not been observed the cirrostratus clouds, nor the solar halos, nor the characteristic sunset colors, which usually indicate the proximity and direction of approach of a typhoon. There remained only the direction of the superficial winds oscillating from north-east to north-west (of little value), and the course of the clouds, which, till 1 A.M. of the 20th, came from the north-east. At 3 P.M. of the 19th, warning was given from the observatory, ‘Signs of a cyclone at the south-east;’ but there were no unusual barometric changes. It was at this time more than 370 miles away, with a destructive diameter of about 80 or 90 miles.

From 10 P.M. of the 19th to 4 A.M. of the 20th, the barometer went down more than .15 of an inch: at this time warnings were sent to all the public offices that danger was imminent, and word was telegraphed to Hong Kong that a typhoon was beginning at the east of Manila, and was proceeding west-north-west. At midnight it began to fall more rapidly till 8 A.M. of the 20th; and then, in two hours, fell from 746 mm. (29) to 728 mm. (28.4). About noon

it began to rise as rapidly till 2 P.M., and then gradually to 756 mm. ($29\frac{1}{2}$) at 10 P.M.

Thermometer.—At noon of the 19th it stood at 32° C. ($89\frac{1}{2}$ ° F.); it gradually went down to 24° C. (75° F.) at 7 P.M.; it remained at this point till about 11 A.M. of the 20th, and then in less than an hour went up to 31° C. (88° F.), and descended again to 24° C. (75° F.), at 10 P.M. standing at 26° C. (79° F.).

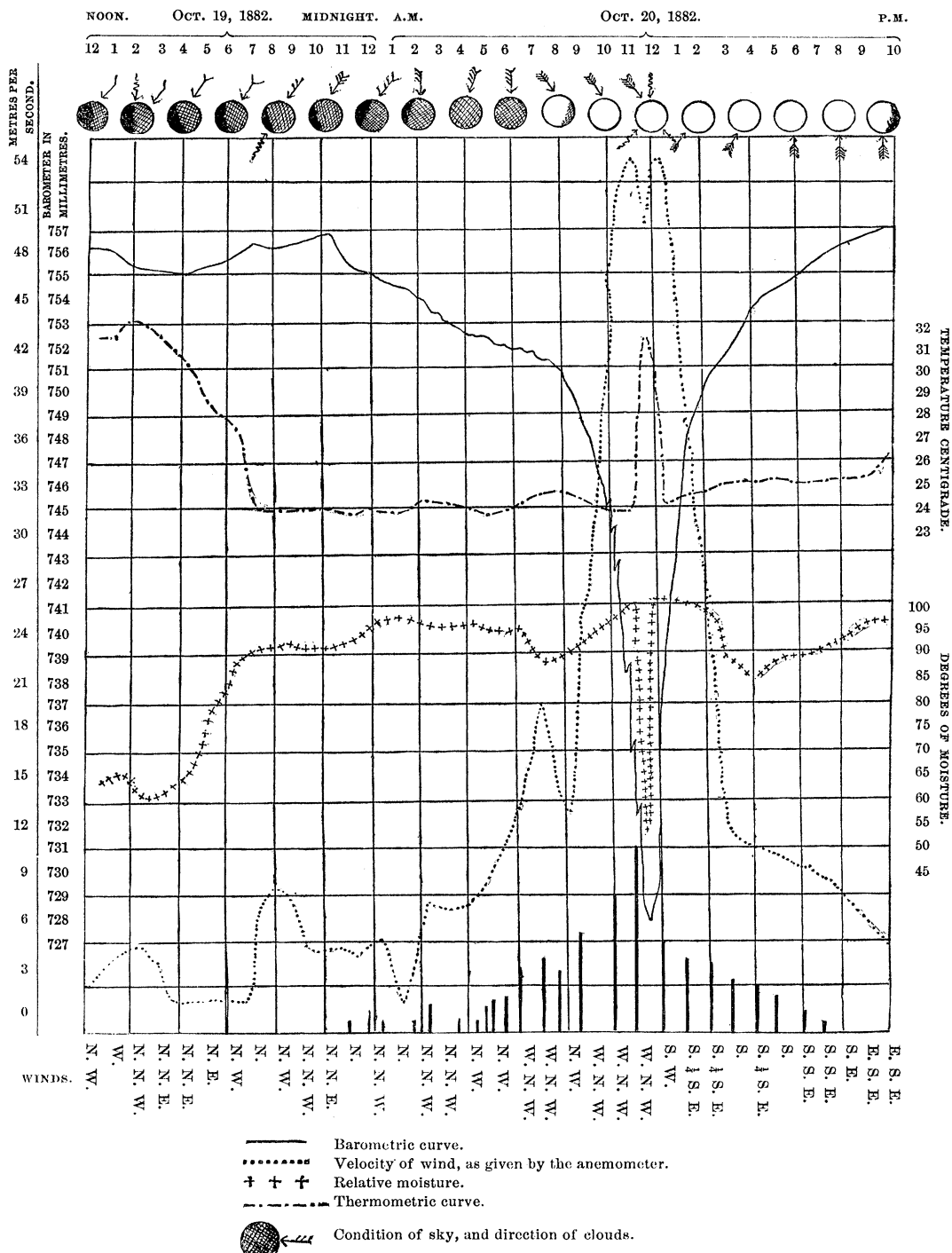
Moisture of Air.—It occurred toward the end of the rainy season, and during the south-west monsoon. At noon of the 19th it was 65, rapidly rising between 2 and 6 P.M. to 90, and varying from that to 95 till 10 A.M. of the 20th; at 10.30 it was 100; then in half an hour it went down to 55, and back again to 100, thence gradually declining to 90–95 at 10 P.M.

Velocity of Wind.—There was comparative stillness till 6.30 P.M. of the 19th; from then to 4 A.M. of the 20th it rarely exceeded 20 feet per second; then in three hours it rose to 63 feet, and, after a half-hour’s descent to 40, in $1\frac{1}{2}$ hours, or at 11 A.M., reached at least 180, and probably more, as at the height of the gale the registering instrument was carried away: this is equivalent to about 125 miles an hour, and the velocity may have attained 140 miles. In an hour it began to diminish rapidly, and at 1.30 P.M. had gone down to 33 feet, and to 13 at 10 P.M. After several sudden changes, at 2 A.M. it began to blow from the north-west, and so continued till about noon, when it shifted suddenly to the south-west for half an hour, and then blew from south-south-east and east-south-east up to 10 P.M.

Rain.—Rain began to fall just before midnight, 19–20th, and increased, with occasional lulls, to about 11 A.M., when it fell in torrents; after that it gradually decreased, and ceased about 8 P.M. It was accompanied by some lightning.

Direction.—The storm entered the archipelago over the Catanduanes Islands, near Tabaco and Albay, and went across the east of the North Camarines, near Daet, judging from the successive positions of the vortex, then passing over Manila and to the China Sea, by Subig. The course was therefore from south-east to north-west, and its velocity 19 miles an hour, the greatest ever known here.

Form.—The barometer went down much more slowly than it ascended; whence it may be deduced that the curves of equal pressure were not circular, being wider at the anterior than at the posterior part of the typhoon, forming a kind of ellipse, in which one of the foci occupied the vortex. The tracing of the



The arrows indicate not only the direction of the clouds, but also their velocity, represented by the barbs, six marking a hurricane force; the zigzag arrows indicate lightnings, and the point of the horizon where they were observed; the empty circles indicate a sky completely hidden.

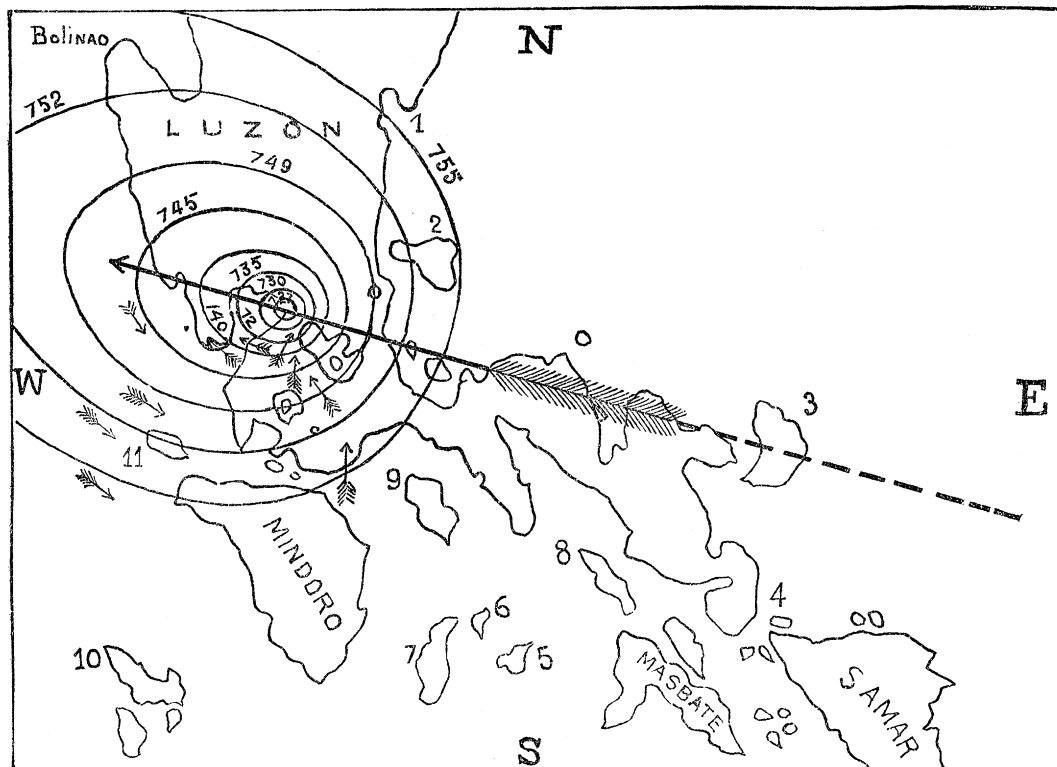
The heavy vertical black lines at the bottom of the chart indicate the amount of rain.

isobaric lines is strongly in favor of the theory of converging winds, and apparently fatal to that of the long-held one of circular winds.

Vortex.—At 11.46 A.M. (20th), after a violent rush from the west-north-west, Manila was in the vortex. The calm was not absolute, but with alternate gusts and lulls for about eight minutes; at 11.52 the calm was absolute for two minutes; then alternate calm and gusts from the south-west. Blue sky was

dows during the calm were instantly compelled to close them, for the air 'burned' as in the Italian sirocco.

Barometer.—The lowest barometer was at 11.40, or 6 minutes before entering the relative, and 10–12 before the absolute, calm; at this time Manila was probably the nearest to the centre of the vortex. At 11.54 it began to rise rapidly, the wind changing suddenly to the south-west, but with equal violence. The



MAP SHOWING THE COURSE OF THE HURRICANE, AND THE DISTRIBUTION OF THE ISOBARIC LINES AROUND THE CENTRE.

- 1.—Bay of Casiguran. 2.—Island of Polillo. 3.—Catanduanes Islands. 4.—Strait of San Bernardino. 5.—Island of Sibuyan. 6.—Island of Romblon. 7.—Island of Tablas. 8.—Island of Burias. 9.—Island of Marinduque. 10.—Calamianes Islands. 11.—Island of Luban. 12.—Bay of Manila. The large arrow indicates the course of the hurricane, and horizontal section of the same, as it passed over Manila. 755 to 727 mm. (29.45–28.35 in.) the fall of the barometer.

not seen, but it cleared to a dense watery vapor; the dark belt of the storm could be traced on the horizon. The diameter of the vortex was probably not more than 14 or 16 miles.

Changes.—The most striking phenomenon was the sudden change of temperature and hygrometric condition of the air, as revealed by the curves traced; the former from 75° to 88° F., and the latter from 53 (rarely observed here, and only in April and May) up to saturation. Persons who opened their win-

blow lasted 2½ hours; and its traced fury for the last half of the diagram was estimated, but not observed for want of instruments.

At 12.30 the dense clouds began to rise quickly, indicating that at the posterior part of the storm the winds had also mounted higher. It was peculiarly destructive, as Manila was exactly at the point of this sudden change of elevation.

Force.—The observatory is about 113 feet above sea-level. Just before 11 A.M. the wind tore up a palma brava some 1,000 feet

away, raised it to the height of the observatory, and carried it against the cast-iron column through which pass the connections between the top and the registering apparatus; destroying the same, and preventing further observation of the anemometer. Manila was in the centre of the greatest violence; at a short distance from the city, the barometer stood $3\frac{1}{2}$ tenths higher.

Effects.—The typhoon was the most severe that has visited the islands for fifty years. Houses were unroofed, vessels driven ashore, whole villages prostrated, trees torn up by the roots; metal plates, tiles, timbers, and heavy weights were carried to great heights and distances. Millions of property were destroyed in the city and its suburbs; the growing cane and hemp in the provinces were seriously damaged; thousands of people are houseless and penniless, and general distress and business prostration are the result. The rain saturated every thing that the wind exposed; what was left, more or less injured, was further ruined by another typhoon of almost equal violence, which occurred Nov. 5.

SAMUEL KNEELAND.

CAPTAIN C. E. DUTTON ON THE HAWAIIANS.

CAPTAIN DUTTON of the United-States Army has just returned from a sojourn of seven months on the Hawaiian Islands, where he went for the purpose of studying the volcanic phenomena. Although most of his time was necessarily devoted to geological investigation, he yet found time to collect a large mass of ethnological data, which he presented in a most interesting form at a meeting of the Anthropological Society of Washington, held Jan. 2.

He said that in color the inhabitants are of a bronze shade about midway between the color of the North-American Indian and the Malayan. The general features, however, are very unlike those of our Indians, and partake in part of the character of the European and in part of that of the African tribes, though more strongly of the former. In stature the Hawaiians are large, and equal the Anglo-Saxon race. There are, however, two broadly marked social castes, and these differ physically almost as widely as they do socially. The ruling class are lighter in color, and larger in stature, being usually above six feet in height, and sometimes reaching six feet seven inches. They also tend to obesity, and are readily distinguishable from the lower classes in numerous other ways. The Hawaiian Islanders belong to the finer and better of the two great races of men which about equally share the Polynesian Islands. They were never cannibals, and nothing offends them more than the charge of having eaten Captain Cook.

Many facts point to the East-Indian Archipelago as the portion of the globe from which these people originally came; and among these evidences are their possession, when first seen by Europeans, of the dog, the pig, and the domestic fowl, none of which could have come from America. Their language allies them very closely to certain Bornean tribes,

and particularly to the Dyaks. This affinity is especially observable in their numerals.

Their legendary lore, which is amazingly rich, also belongs to the East-Indian type, and even partakes in a striking manner of the character of that of India, Western Asia, and Egypt. Their myth relating to the creation of woman is identical with that in Genesis, and may have been borrowed from the early missionaries; but against this view is the remarkable fact that it appears in an archaic form of their language which only the priesthood can fully understand. The present king Kalakaua is much interested in the ethnology of his people, and believes in their American origin, — a belief which the speaker did not share.

The population of the Hawaiian Islands is dense, and every thing points to the conclusion that this has been the case for a very long period. The arable lands are confined to belts around the islands extending inward from six to twelve miles to the beds of lava or steep sides of the mountains. These lands are divided up into very small lots by means of stone walls.

The state of society is by no means low or savage. Society is well organized according to a rigid system. This system very closely resembles the feudal system of European history, having all the classes which characterized that system. Prior to the consolidation of all the governments of the islands by Kamehameha I., in the early part of this century, there existed on each island a number of independent kingdoms. The kings were the proprietors of all lands, which they parcelled out to subordinate chiefs, whose tenure was strictly analogous to enfeoffment, with this exception, that, in addition to homage and military service, tribute was also exacted of them. The latter subdivided their fiefs among their retainers on similar conditions, and these turned them over to the lowest, or working classes, to cultivate; which latter were the true *villeins*, who were merely tenants at will. Still this latter form of tenure was the most permanent; since the chiefs were liable to be changed by military reverses and royal displeasure, while the *villeins* remained, as in Europe, practically *adscripti glebae*. The priesthood was almost always found supporting the king. This class maintained, down to the reign of Kamehameha II., the most despotic sway over the people, and chiefly through the principle involved in the terrible word *tabu*. The fundamental idea underlying this term is *divine prohibition*, and the penalty for the breaking of a *tabu* was always death. The people submitted to this in the firm belief that death in some form was certain to follow such offences; and that, if man did not inflict it, the gods surely would. *Tabus* were either permanent, recurrent, or merely temporary and arbitrary. Among the permanently *tabued* acts was that of the sexes eating together. Special *tabus* were prescribed by the king, with the advice of the priesthood.

The speaker went on to describe in detail the mode of subdividing the land for agricultural purposes, the skill displayed in irrigation, the principal products of the soil, the leading articles of food and how they are prepared, the character of the houses, the manufacture of tappa-cloth and of mats out of the screw pine, the culinary utensils and dishes used; the implements manufactured and the materials yielded by the country for these purposes; the modes of fishing; the kind of dress worn; the elaborate robes, cloaks, helmets, etc., made for the kings, of yellow and red feathers; and the use of nuts as candles. He further treated of the military tactics of the Hawaiians, and the arms employed; of their

canoes, and mode of navigation, by which they have frequently visited the Society Islands, a distance of 2,400 miles. They knew much of astronomy, and possessed an accurate calendar, dividing their year into twelve months of thirty days, with allowance for the bissextile. Their year begins at the time when the Pleiades rise at sunset. They count to millions, with names for all their numbers. The priests know every plant on the islands, and are especially familiar with their toxic properties. Interesting remarks were made on their language, their mythology, and their religion. Legends and royal pedigrees are handed down with great exactness by a special class who make this their only business. The language of their classic lore is archaic, and unintelligible to the common people. The genealogy of kings is traced back a hundred generations. Descent is here in the male line, but descent of property among the other classes is in the female line. This is rendered necessary from the fact, that with the exception of the queen, who is *tabu* and therefore chaste, chastity in women is regarded as a disgrace, in that it denotes a want of attractions. Monogamy prevails, but divorce is easy and sexual morality excessively lax. The dead are buried in caves in the mountains, in a sitting posture. Until recently human sacrifices were of frequent occurrence. Criminals are executed secretly with a club. Walled enclosures constituted their "cities of refuge." Their temples in the form of parallelograms were also described.

Captain Dutton closed his remarks by rapidly glancing at the influence of the missionaries, and the modern innovations and modifications in Hawaiian society.

VARIATIONS IN THE VERTICAL DUE TO ELASTICITY OF THE EARTH'S SURFACE.

In the Philosophical magazine for December, 1882, Mr. G. H. Darwin discusses this subject. He considers first the disturbance due to variations of barometric pressure; second, those due to the rise and fall of the tides. Mr. Darwin has previously investigated "the state of stress produced in the earth by the weight of a series of parallel mountains" of such shape that the equation to the outline of the section made by a plane traversing all the mountains and valleys perpendicularly is $x = -h \cos \frac{z}{b}$; the axis of x being supposed vertical, and that of z horizontal and perpendicular to the mountain chains.

Taking the origin in "the mean horizontal surface, which equally divides the mountains and valleys," and midway one of the mountains, and letting " a, γ , be the displacements at the point x, z , vertically downwards and horizontally," he finds, when $x = 0$,

$$a = \frac{gwh}{2v} b \cos \frac{z}{b}, \quad \gamma = 0, \quad \frac{da}{dz} = -\frac{gwh}{2v} \sin \frac{z}{b}.$$

In these equations, w is "the density of the rocks of which the mountains are composed; g , gravity; v , modulus of rigidity."

If we suppose the region to have been originally a plane, such as would be formed by toppling over the upper half of each mountain into the neighboring valley, the quantity $\frac{da}{dz}$ above is the present real inclination of what was originally the horizontal surface stratum.

The apparent inclination, however, as measured by means of the plumb-line, is something different from the above, owing to the change in the direction of the latter due to the changed distribution of the attracting

masses about it. One of the most interesting portions of Mr. Darwin's present paper is the proof of a very simple ratio, for any such case as that now under consideration, between the deflection of the plumb-line and the slope $\frac{da}{dz}$ of the stratum $x = 0$.

This relation, which was pointed out to Mr. Darwin by Sir William Thomson, though the proof here given is due to the former alone, is as follows:—

If δ be the earth's mean density, r the earth's radius, and v, g , as above, the deflection bears to slope the same ratio as $\frac{v}{g}$ to $\frac{1}{3} r \delta$. "This ratio is independent of the wave-length $2\pi b$ of the undulating surface, of the position of the origin, and of the azimuth in the plane of the line normal to the ridges and valleys. Therefore the proposition is true of any combination whatever of harmonic undulations; and as any inequality may be built up of harmonic undulations, it is generally true of inequalities of any shape whatever." With rigidity as great as that of steel, the slope is $1\frac{1}{2}$ times as great as the deflection.

"In the problem of the mountains, $w h$ is the mass of a column of rock of one square centimetre in section, and of length equal to the height of the crests of the mountains above the mean horizontal plane. In the barometric problem, $w h$ must be taken as the mass of a column of mercury, of a square centimetre in section, and equal in height to a half of the maximum range of the barometer."

This maximum range is assumed to be 5 centimetres. The rigidity of the earth is supposed to be 3×10^8 million grammes per square centimetre, — greater than that of the most rigid glass. The distance from the region of high to that of low barometer is taken as 1,500 miles.

With these data, it is found "that the ground is 9 centimetres higher under the barometric depression than under the elevation."

The maximum slope of the surface, which is found midway between the regions of high and low barometer, is $0''.0117$; and for the maximum apparent deflection of the plumb-line, "this is augmented to $0''.0146$ when we include the true deflection due to the attraction of the air."¹

In the problem of the tides, Mr. Darwin imagines, as before, "an infinite horizontal plane which bounds, in one direction, an infinite, incompressible, elastic solid." Upon this he lays off straight strips of equal and uniform width, representing alternately areas of land and of water. At full tide, the surface will be such that for it x will be a discontinuous periodic function of z . This function having been developed according to Fourier's theorem, the results of the previous investigations become applicable.

It is thus found that "midway in the ocean and on the land there are nodal lines, which always remain in the undisturbed surface," whether the tide be high or low on either coast; "that the land-regions remain very nearly flat, rotating about the nodal line, but with slight curvature near the coasts."

¹ Mr. Darwin remarks that this last result is independent of the wave-length of the barometric inequality, and so it appears from the formula. It would seem, however, that the above correction for the attraction of the air is only applicable when the wave-length is very considerable compared with the height of the effective atmosphere.

This apparent deflection is so great, that, with the deflections caused by the tides, Mr. Darwin concludes it will probably forever mask the lunar disturbance of the plumb-line, the amplitude of this latter disturbance being by calculation only $0''.0216$. This conclusion will probably put an end to the laborious and refined experiments which he and his brother have been conducting for two or three years in order to detect and measure the lunar action.

Assuming the width of the seas and continents to be 3,900 miles, the rigidity of the earth to be 3×10^8 , as above, and the range of the tides to be 80 centimetres, Mr. Darwin computes and gives tables of the slopes, real and apparent, of the land at various distances from the coast. Such deflections, he thinks, might actually be observed at points near the coast, and the measurements thus obtained might possibly serve as a basis for computing a more trustworthy value of the earth's rigidity than we now possess.

Under the conditions above assumed, the amplitude of vertical displacement between high and low tide is 11.37 centimetres on the land at the coast.

"As long as $h \neq 1$ "—i.e., the semi-range of the tide multiplied by the width of a sea or continent—"remains constant, this vertical displacement remains the same; hence the high tides of ten or fifteen feet which are actually observed on the coasts of narrow seas must probably produce vertical oscillations of quite the same order as that computed." E. H. HALL.

LETTERS TO THE EDITOR.

[Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.]

Age of the rocks on the northern shore of Lake Superior.

PERMIT me, through the medium of your journal, to correct a mistake which Prof. N. H. Winchell has made (*Tenth ann. rep. surv. Minn.*, p. 125) in stating that I regard the trap and sandstone of Lake Superior as Huronian.

Up to the present time I was not in a position, never having examined them, to express any opinion about the Lake Superior formations referred to.

During the past summer I have somewhat closely examined these around the whole of the Canadian shores, from Prince Arthur's Landing to Sault St. Mary, including the shores of Thunder Bay, Black Bay, and Nipigon Bay and Straits. I spent two months in this examination, travelling from point to point in a small boat.

My opinion now, respecting the character and age, — within certain limits — of these rocks is very decided, and is as follows:—

They occupy the geological interval elsewhere filled by those divisions of the great lower paleozoic system which underlie the Trenton group. Various considerations point to the Potsdam and Primordial Silurian (Lower Cambrian) as their nearest equivalents. They are entirely unconformable to, and physically distinct from, the Huronian. They are divisible on the Canadian shores into two, perhaps three, groups, between which there may be slight unconformities. These, however, are quite likely only such as might result from the intermingling of ordinary sedimentary strata with irregular layers of erupted volcanic material, molten, muddy, and fragmentary; the whole being subsequently, and even during their accumulation, further disturbed by faulting, and the irruption of igneous dykes and masses.

To my mind, there can be no doubt as to the nature of the causes which have built up the vast masses of strata, which now, together with ordinary sedimentary layers, form the so-called upper copper-bearing rocks of Lake Superior. They are essentially volcanic, subaërial, and subaqueous formations, and in every sense analogous to the wide-spread tertiary volcanic rocks of Australia and other regions. The only differences are their greater antiquity, and the consequent greater changes and modifications they have undergone through the operation of long-con-

tinued metamorphic agencies, disturbance, and denudation; though these changes are far less than those which the rocks of the same age, and to some extent similar origin, have undergone in eastern America and in Britain; and in this they correspond with the higher fossiliferous groups in the respective regions.

The groups in ascending order are, —

1. Black shales, flinty and argillaceous, banded chert, with black dolomites and beds of fine-grained dark-gray sandstone with mica in the bedding planes; the whole interbedded with massive diabase or dolerite, often columnar, the columns vertical. — Pie Island, McKay's Mountain, Thunder Cape, etc.

2. Red conglomerates, red and white and green mottled shales, red and white sandstones and dolomites; no gray or black beds. At perhaps a hundred and fifty or two hundred feet from the base, these become interstratified with massive beds of volcanic material, amygdaloids, melaphyres, tuffs, etc., making many thousand feet of strata. — East shores of Black Bay, Nipigon Strait, St. Ignace and other islands, Michipicoton Island, Gargantua, Mamainse, etc.

3. The Sault St. Mary sandstones. These may be only the upper part of 2, without any intermingling of volcanic material. The exposures on the Canadian side are too fragmentary and isolated to decide this. In any case the St. Mary sandstones are not younger than Chazy (Cambro Silurian), but in the absence of fossils it is impossible to correlate the Lake Superior groups exactly with any one of the subdivisions of the New York or the Atlantic coast series. This, however, is no sufficient reason for inventing and adopting new and unknown names for them; and I prefer to call them all Lower Cambrian, which includes Potsdam and Primordial Silurian. There is, at present, no evidence whatever of their holding any other place in the geological series. Through overlapping and faulting, all three divisions are found locally in contact, both with Huronian and with Laurentian rocks. The dips are generally south-eastward, but vary greatly in amount, those of division 2 being often locally much higher than any observed either in divisions 1 or 3. A. R. C. SELWYN.

Geol. and nat.-hist. survey of Canada.
Ottawa, December, 1882.

Movement of the arms in walking.

Every man has observed that the tendency to swing the arms while walking is a most natural one. The action is rhythmical, the anterior and posterior extremities of opposite sides of the body moving in unison. It is also involuntary, being performed most readily when thought is not bestowed upon it. When voluntarily suspended, as in the American army, it gives an air of 'stiffness.'

In view of these facts, does it not seem that the statement of Prof. J. D. Dana (Cephalization; *Amer. Journ. sc.*, xli, 1866, p. 167), sanctioned by Dr. T. Gill (Classif. families of mammals, 1872, p. 50), — namely, that "Man stands alone among mammals in having the fore-limbs not only prehensile, but out of the inferior series, the posterior pair being the sole locomotive organs," — must be somewhat modified? Have we not at least a ghost of a pre-existing function? Does man walk by means of his feet and legs alone? FREDERICK W. TRUE.

U. S. national museum, Washington, D.C.,
Nov. 18, 1882.

Cleaning birds.

When obliged to wash birds, collectors will find it an advantage to use salt and water instead of plain

water. The salt prevents the solution of the blood-globules and consequent diffusion of the red haemoglobin.

J. AMORY JEFFRIES.

THE ORIGIN OF CULTIVATED PLANTS.

Origine des plantes cultivées, par ALPH. DE CANDOLLE. (Bibliothèque sc. internat., tom. xliii.)
Paris: Baillière & Cie., 1883. 8vo.

It is a common saying, that the plants with which man has most to do, and which have rendered him the greatest service, are those of which botanists know the least. That this should hold true of the plants of immemorial cultivation, as regards both their limitation in species and their sources, is not to be wondered at. The reason why many of these cannot be identified with wild originals is because, in all probability, the originals have long been extinct. Even when spontaneous examples have been found, it is sometimes far more probable that these are the offspring of the cultivated plant relapsed into wildness, than that they are vestiges of an original stock. Indeed, plants of comparatively recent acquisition to Europe are still puzzles; of not a few the question is still open whether they originated in the new or in the old world. The herbalists and ante-Linnean botanists gave little attention to the original sources of the plants they described, and Linné still less. Following erroneous indications, he assigned the common sunflower to Peru; and its relative, the tubers of which we call artichokes, to Brazil; when he might have known that they both were sent to Europe from Canada. It is only within the present century that any considerable attempts have been made to solve such problems. Robert Brown, Humboldt, and the elder De Candolle opened the way; and Alphonse De Candolle, who has particular aptitude for this class of investigations, is one of the few who have undertaken to discuss this subject systematically. Almost thirty years ago, in his *Géographie botanique raisonnée* (2 vols. 8vo, 1855), just before the Darwinian deluge, which swept away some of the old landmarks, and changed the face of many things, De Candolle discussed in detail the changes which have taken place in the habitation of species, and has a long chapter on the geographical origin of cultivated plants. In this the then existing knowledge is well brought up to date, systematized, and critically treated.

This book is out of print. Greatly as it is needed, the author, who is older than he was, recoils before the labor of a new edition of the whole work. But he has taken up the

subject of the origin of cultivated plants anew, and the present volume is the result.

The number of species of cultivated plants here passed in review seems at first sight to be wonderfully small, viz., only 247, or, reducing certain races to their supposed types, little over 240. But species cultivated for ornament and for medicine or for perfume are rigidly excluded; while, on the other hand, so insignificant a forage-plant as spurrey, so poor and weedy a pottage-plant as purslane, a plant which we know only in ornamental culture and for its medicinal product, castor-oil, and a fruit-tree of such slight pomological importance as the American persimmon, are included. The latter and its old-world analogue are, indeed, only enumerated; but no one cultivates persimmons in this country. It is said that no plant of established field-culture has ever gone out of cultivation, at least in modern times, except perhaps woad; but, thanks to the chemists, madder is doomed already, and indigo is to follow.

Although Humboldt could affirm, so late as in the year 1807, that the original country of the vegetables most useful to man remains an impenetrable secret, so great progress seems to have been since made that De Candolle is able to assort his 247 species into 199 furnished by the old world, 45 by America, and only three which are still doubtful in this regard. Here the chestnut, the red currant, the common mushroom, and the strawberry are counted as of European, properly enough; since they were first cultivated in the old world, although indigenous to North America as well. The latter country makes a poor show indeed, when it is said that its only indigenous nutritive plants worth cultivating are the sunflower-artichoke and a pumpkin, though Indian rice (*Zizania*) might have been turned to account if it were not for the true rice. We are not so clear as to any original inferiority, nor that these numbers might not have been more nearly equal if civilization had begun as early in the new as in the old world. Europe had the great advantage of lying adjacent to two other continents, and of being colonized from them by races which were already agricultural.

As respects the three plants of doubtful country, two are species of *Cucurbita* (moschata and ficifolia), comparatively unimportant and little known, which have reached Europe only recently, the latter within thirty or forty years; and the third is *Phaseolus vulgaris*, the bean of the Americans, whose right to it we propose to claim. And we would suggest that

its place in the list should be taken by the cocoanut, the only esculent species common to the two worlds within the tropics which we have reason to suppose was carried or drifted across the Pacific in prehistoric times. Being a littoral tree, with fruit capable of enduring long exposure to salt water, its dispersion is not so surprising. The question is, in which direction the dispersion was effected; and that perhaps can never be determined. In his general list De Candolle includes the *Cocos nucifera* among the plants of old-world origin, with queries whether of the Indian archipelago, or of Polynesia. In his former treatise he inclined to the theory of a transmission westward from the Pacific coast of Central America: in the body of the present work, after full statements *pro* and *con*, he is disposed to reverse his former opinion. But, as the dispersion may have been mainly by natural agencies, the question may be relegated to another class of inquiries. The presumption arising from the fact that all other species of *Cocos* are American, may be offset by the asserted fact that, although the tree formed forests on the islands off Panama when these were first visited by Europeans, it would appear to have only recently reached the West Indies and the adjacent main. So useful a tree, if indigenous to one side of the isthmus, would have been transported to the other and to the islands beyond by the very earliest races of men. As to oceanic transport, judging from the charts, the drifting of cocoanuts from America to Polynesia by the great current south of the equator seems hardly more or less likely than the reverse by the return equatorial current north of it.

It would be well to give some account of our author's method of investigation and exposition, of the kinds of evidence which are brought to bear upon the questions discussed, botanical, paleontological and archeological, historical and linguistic, each bringing some light of its own sort, and in their coincidence giving all the assurance of which such inquiries admit. It would be interesting to show, moreover, that although in most cases the continent or even the country from which each plant came to Europe, or in which it has been immemorially cultivated, has been fairly well ascertained, their origin or parentage has not. Only one-third of them are really known to botanists in a natural or wild state; and from this number subtraction may be made of such as have been detected only once or twice, and which may merely have run wild: the common tobacco-plant of the new world, and

the bean of the old, are in this category. On the other hand, there are several which botanists confidently trace to indigenous originals from which the cultivated plant has undergone considerable alteration: of such are the olive, the vine of the old world, flax, and the garden poppy; and in America, the potato, the sunflower-artichoke, and the tomato. But we know not, and we probably shall never discover, the particular source or origin of the cereal grains of the old world, and of maize in the new; of sorghum and sugar-cane; of the pea, lentil, chick-pea, and peanut, and of the common white bean; of sweet-potato and yams; and nearly the same may be said of the peach, oranges and lemons, and of all squashes and pumpkins.

But we must conclude our brief review with a note upon two or three plants, the early history of which concerns our own country.

Phaseolus vulgaris, our common bean,¹ ranks in De Candolle's table as one of the three esculent plants, the home of which, even as to continent, is completely unknown. Linné credited it to India, as he did our Lima bean also; but he took no pains to investigate such questions. This has been so generally followed in the books, that even the Flora of British India in 1879 admits the species, adding that it is not anywhere clearly known as a wild plant. But Alph. De Candolle, in his former work, had discarded this view, on the ground that it had no Sanscrit name, and that there was no evidence of its early cultivation in India or farther East. Adhering, however, to the idea that our plant was the *Dolichos* and the *Phaseolus* or *Phaselos* of the Greeks, and of the Romans in the time of the Empire, he conjectured that its probable home was in some part of north-western Asia. But recently, as "no one would have dreamed of looking for its origin in the new world," he was greatly surprised when its fruits and seeds were found to abound in the tombs of the old Peruvians at Ancon, accompanied by many other grains or vegetable products, every one of them exclusively American. In his present very careful article he admits that we cannot be sure that it was known in Europe before the discovery of America, and that directly afterwards many varieties of it appeared all at once in the gardens, and the authors of the time began to speak of them; that most of the related species of the genus belong to South America, where, moreover, many sorts of beans were in cultivation before the

¹ Bean in Great Britain is *Faba* (the fève of the French), and the varieties of *Phaseolus* are called French beans.

coming of the Spaniards: and the idea that it might have been native to both hemispheres is discarded as altogether improbable. Upon this showing, it would appear that the plant should have been set down as of American, rather than of wholly unknown, origin. Indeed, when all the evidence is brought out, the discovery of these beans in the Ancon tombs need excite no more surprise than that of the maize which accompanied them.

For maize, beans, and pumpkins were cultivated together, immemorially, all the way from the Isthmus to Canada. And, although some of the sorts of beans mentioned by Oviedo in 1526, as raised in great abundance in Nicaragua where they are native, and also of those everywhere met with by De Soto (1539-42) in his march from Tampa Bay in Florida to the Mississippi, doubtless belonged to *Phaseolus lunatus*, yet most if not all of those which at the same early period Jacques Cartier found cultivated by the Indians of Canada, must have belonged to *Phaseolus vulgaris*, or its dwarf variety *P. nanus*; for only these are well adapted to the climate of Canada especially the low and precocious variety, which alone has time to mature between the spring and the autumn frosts. Indeed those same beans, derived from the Indians along with maize and pumpkins, have doubtless continued here in New England in direct descent, to form that staple diet for which the northern part of the coast of Massachusetts has long been famous; so that when Rufus Choate, defending a ship-captain against a charge of ill-treatment in having fed his crew exclusively upon it, rehearsed, in his accustomed affluence of language, the praises of "that excellent esculent and superlatively succulent vegetable, the bean," he was celebrating the good qualities of a distinctively and aboriginally American article of food.

We are not to suppose, however, that this species had its home in North America, at least north of Mexico. The same may be said of our squashes and pumpkin, for which similar reclamation may be attempted upon another occasion.

The cultivators of more than one department of science have reason to thank our author for having returned in mature age to the studies of a third of a century ago, and to admire the thoroughness, patience, sound judgment, affluence of knowledge, and felicity of exposition, which characterize this, as indeed they do all his writings. We are well pleased that the first number of our new journal should introduce to

the American public an important contribution to science by De Candolle. ASA GRAY.

NATURAL HISTORY OF MINNESOTA.

The geological and natural-history survey of Minnesota. The tenth annual report for the year 1881. N. H. Winchell, State geologist. St. Paul: 1882. 254 p., 14 pl. 8vo.

THE principal part of this volume consists in the Preliminary list of rocks and Typical thin sections of the rocks of the cupriferous series in Minnesota, articles which appear to be the result of the penurious way in which Minnesota, in common with many other states, deals with her geological survey, compelling the state geologist to do work that ought to be done only by competent skilled lithologists. The results in this case, as elsewhere under similar circumstances in our country, are the same as they would be with paleontology, were the average state geologist compelled to work up all the fossils of his survey. Good lithological work requires something more than a microscope, a few thin sections, and a fair knowledge of minerals.

The convenient summary of opinions which have been held of certain rocks in the Lake-Superior region given on pp. 123-126 appears to be a digest of the more elaborate statements made in Dr. Wadsworth's notes on the geology of this district (Bull. mus. comp. zool., vii. No. 1), with additions of a later date, although no credit is given to that writer; on another page of SCIENCE, Mr. Selwyn takes exceptions to the views accredited to him, though Mr. Winchell would seem at first sight to be warranted in his statements from Mr. Selwyn's Canadian report of 1877-78, pp. 9 A, 14 A. The execution of the three maps accompanying the Minnesota report is to be praised.

In the zoological section of the report, Mr. C. L. Herrick presents a second contribution to a knowledge of the fresh-water Crustacea of the state. In this, as in his first paper (Seventh report, 1878), he limits himself almost entirely to the microscopic Entomostraca. These two papers, with Birge's Notes on Cladocera (of Cambridge, Mass., and Madison, Wisc.), comprise about all the systematic work on these animals done in this country. There is as yet, then, no basis for a discussion of their geographical distribution. According to Mr. Herrick, sixteen out of the thirty-three species described are also European. Thirteen species are new, and two new genera are established. Looking over

the specific descriptions, it appears to us that Mr. Herrick trusts too much to such characters as the number and arrangement of the joints of the antennae, which change with the growth of the individual. Even sexual maturity in these animals does not determine the limit of structural change.

Besides the microscopic forms, two species of cray-fish are recorded, — *Cambarus virilis* Hagen and *C. signifer* sp. nov. Attention is again drawn to the curious fact that size does

not govern the transition from the 'second form' or sexually immature (?) male to the 'first form' or perfected state; the second form often exceeding the first in its dimensions. Zoölogists whose lot it is to live in a cray-fish country cannot be too strongly urged to study the habits and physiology of these so-called dimorphic males. Types of the 'new' species, *C. signifer*, kindly communicated by Mr. Herrick, prove to be *C. immunis* Hagen. Eleven plates accompany this memoir.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Quadrature of the circle.—In vol. xx. of the *Mathematische annalen*, Lindemann gave a proof of the fact that π cannot be a root of an equation of any degree with rational co-efficients. This is a most remarkable paper, as it thus contains the first direct, absolute proof that has ever been given of the impossibility of the quadrature of the circle. M. Lindemann's investigation is based upon, and presupposes a knowledge of, Hermite's earlier paper, in which he showed that e , the Napierian base, cannot be the root of an equation with rational co-efficients. The fact that Lindemann has started from Hermite's results makes his paper rather hard reading; and on this account, the author of the article at present referred to, M. Rouché, has thought it worth while to give an account of the work done by Hermite, and more recently by Lindemann, and at the same time to simplify the processes in both cases. M. Rouché has really done very little in the way of simplification, but by bringing together the proofs he has produced an interesting and valuable paper. He professes the belief that the last word has not yet been said on the subject, but that another and simpler proof will yet be given of the fact that π cannot be a root of any equation of any degree with rational co-efficients. Lindemann has certainly done a splendid piece of work in thus absolutely proving the impossibility of 'squaring the circle;' and it is only to be regretted that his work will not carry conviction to the minds of those mistaken individuals, the 'circle-squarers.' But it is hardly to be supposed that they will be convinced of the futility of their task, any more than the perpetual-motion inventors were convinced by the discovery and enunciation of the principles of the conservation of energy. — (*Nouv. annales*, Jan., 1883.) T. C. [1]

Geodesic lines.—The author, Herr A. v. Braunmühl, considers the case of geodesics upon triaxial surfaces of the second order. He derives first Weierstrass' formulas for a general geodesic, and obtains forms for the entering constants in terms of the double *theta*-functions, rendering them easy of computation. Examples are given of the computation of geodesic lines in the general and in several special cases. The latter, and newer part of the paper, contains a derivation of the equations of the envelopes of geodesics, and a discussion of the same. The envelope is determined by aid of the hyperelliptic functions, and special applications are made to the ellipsoid and two sheeted hyperboloid. Numerous references are given to previous investigations. — (*Math. annalen*, xx., 1882.) T. C. [2]

Abelian and theta functions.—Prof. Cayley in this memoir has reproduced with additional developments the course of lectures which he delivered in the Johns Hopkins University, in the winter and spring of 1882. The memoir has a special interest as being the first of any consequence upon this subject in the English language, and, indeed, one of the most important in any language. The chief addition to the theory consists in the determination made for the cubic curve, and also (but not as yet in a perfect form) for the quartic curve of the differential expression $d\Pi_{\xi\eta}$ (in Clebsch and Gordan's notation) or $d\Pi_{12}$ (in Prof. Cayley's notation) in the

integral of the third kind $\int_a^\beta d\Pi_{\xi\eta}$ in the final normal

form for which $\int_a^\beta d\Pi_{\xi\eta} = \int_\xi^\eta d\Pi_{\alpha\beta}$ the limits and

parametric points interchangeable. The notation and demonstrations of Clebsch and Gordan are much simplified, and the theory is illustrated by examples, in regard to the cubic, the nodal quartic, and the general quartic respectively. The first three chapters only of the memoir have yet appeared. — (*Amer. journ. math.*, v., 1883.) T. C. [3]

PHYSICS.

Acoustics.

Instrument for measuring the intensity of aerial vibrations.—The instrument is based on an experiment described by the author (Lord Rayleigh) in the Proceedings of the Cambridge philosophical society for November, 1880; from which it appeared that a light disk, capable of moving about a vertical diameter, tends to set itself at right angles to the direction of alternating aerial currents. A brass tube is closed at one end with a glass plate, behind which is a slit through which pass rays of light from a lamp. A light mirror with attached magnets, such as are used for reflecting galvanometers, is suspended by a fine silk fibre so that the light from the slit is incident upon it at an angle of 45° , and, after reflection, passes out through the side of the tube by a glass window. A lens is so placed as to throw an image of the slit upon a scale. The opposite end of the tube, prolonged to a distance equal to that between the slit and mirror, is closed by a diaphragm of tissue-paper. A sliding tube extends for some distance beyond this. If the instrument is exposed to sounds whose half-wave-length is equal to the distance from the slit to the tissue-paper diaphragm, nodes are formed at each

end of the tube, and the mirror, being half-way between these, is at a loop. Hence it tends to set itself at right angles to the vibratory motion. This tendency is opposed by the magnetic forces; but the image on the scale shifts its position through a distance proportional to the intensity of the action. The instrument reveals an enormous disproportion between sounds which, when heard consecutively, appear to be of the same order of magnitude. — (*Phil. mag.*, Sept., 1882.) C. R. C. [4]

Optics.

Absorption spectra of ozone and pernitric acid. — The places of eleven absorption bands due to ozone are catalogued by M. J. Chappuis according to wave-length. Of these, by far the most intense are those having the limits $\lambda = 609.3$ to 593.5 and $\lambda = 577.0$ to 560.0 , which are Nos. 2 and 3 of the table; next in intensity is $\lambda = 535.0$ to 527.0 , which is No. 5 of the table. These bands were observed in light which had traversed a tube 4.5 m. long, containing ozonized oxygen prepared at the atmospheric pressure and a temperature of 15°C . Variations of length of tube and pressure of gas were accompanied by a variation in the intensity of the absorption bands, such that the effect produced seemed proportional to the quantity of ozone traversed by the light. A lowering of temperature, however, produced, independently of change in density, an increased intensity of the bands. M. Chappuis succeeded also in observing the absorption spectrum of the blue liquid which is obtained by compressing a mixture of carbon dioxide and ozone, in which he found the two characteristic bands Nos. 2 and 3 near D; the absence of the others being attributed to the small quantity of the liquid used.

If the smallest quantity of nitrogen were present in the tube, other bands of a greater intensity appeared, which M. Hautefeuille and the author were led to attribute to an oxygen compound of nitrogen richer in oxygen than nitric acid, and to which they gave the name pernitric acid. The stronger of the bands were readily seen in a tube no longer than 0.1 m. The eight bands attributable to this substance are tabulated and described.

In the second part of his paper, the author gives a discussion of the bearing of his discoveries on the telluric lines of the solar spectrum, with the conviction that the lines 2, 3, and 5 of the ozone spectrum are present in the spectrum of the sun when at the horizon. That a part of the cause of the blue color of the sky is the presence of ozone, is also indicated. — (*Journ. de phys.*, Nov., 1882.) C. S. H. [5]

Reflection of 'actinic' rays. — M. de Chardonnet finds that silver alone, of a large number of solid and liquid bodies, exerts an elective absorption on light of short wave-length. Polishing a body does not alter its action. — (*Journ. de phys.*, Dec., 1882.) C. S. H. [6]

Saccharimeter. — Note by M. H. Dufet on M. Laurent's recent modification of his form of saccharimeter, by adding an absorbing plate of bichromate of potash, whereby a source of white light may be used. — (*Journ. de phys.*, Dec., 1882.) C. S. H. [7]

(Photometry.)

Stellar photometry. — In a discussion of the accuracy attainable by the use of a neutral-tint wedge of glass for the determination of stellar magnitudes, Prof. Pritchard finds that careful measures ought not to be in error more than one-thirteenth of a magnitude. He also finds reason to believe that the ordinarily assumed law, that the brightness of a star

is directly proportional to the square of the aperture of the observing telescope, may lead to sensible errors. The paper contains a table of differences of magnitudes, as determined by himself, compared with the same quantities derived from the Harvard observatory. — (*Month. not. roy. astr. soc.*, Nov., 1882.) C. S. H. [8]

Photometric measurements of the sun, moon, and electric light. — According to the measurements of Pouillet, the sun is radiating 7,000 horse-power per square foot of its surface, or 50 horse-power per square inch. Sir William Thomson states that the normal current through a Swan lamp giving 20 candle-power is 1.4 amperes, with a potential of 40 to 45 volts. Hence the actual work is 61.6 ampere-volts, or watts (so-called). Dividing by 746, we find .083 horse-power for the electric activity in a Swan lamp. The filament is 3.5 inches long, and .01 inch in diameter: hence the area of the surface is .11 of a square inch, and the activity at the rate of .75 horse-power per square inch. Therefore the activity of the sun's radiation is about 67 times greater than that of a Swan lamp for an equal area.

An experiment on sunlight compared with an observation on moonlight made by our author, has led him to conclude that the surface of the moon radiates something not enormously different from one-third of the light incident upon it. The moonlight at the time and place of the observation (York, early in September, 1881, about midnight, near the time of full moon) was found to be equal to that of a candle at a distance of 230 centimetres. The luminous intensity of a cloudy sky was found, about 10 A.M. in York, during the meeting of the British association, to be such that light from it through an aperture of one inch area is equal to about one candle.

An experiment on sunlight last December showed, at one o'clock, the sunlight reaching the author's house to be of such brilliancy, that the amount coming through a pinhole in a piece of paper .09 of a centimetre diameter produced an illumination equal to that of 126 candles. The area of the candle-flame was 2.7 square centimetres, or 420 times the area of the pinhole, and therefore the intensity of the sun's light was equal to 126×420 , or about 53,000 that of a candle-flame. — (*Electr. review*, Dec. 23, 1882.)

Sir W. Thomson's first calculation showing that a Swan lamp giving out 20 candle-power uses up only $\frac{1}{67}$ the amount of energy of the sun for the same unit of surface is interesting; but, if we include the question of the light obtained, quite a different result will be reached. The total area of the carbon filament, as we have seen, is .11 of an inch; but only half of this, or .055 inch (equal to .36 centimetre), can be seen at once; and this gives out 20 candle-power. The area of the pinhole in the last observation was .0063 square centimetre, and gave out 126 candle-power. Hence $\frac{.36}{.0063} \times \frac{126}{20} = 359$, — the intrinsic brilliancy of the sun in terms of the Swan light. The sun therefore radiates 67 times the energy, but 359 times the light, of the Swan lamp, or 5.4 times the light for every horse-power expended.

In May, 1879, the writer conducted some observations on this subject (*Proc. Amer. acad.*, 1880, xv. 236), by which it was found on one occasion that the total brilliancy of the sun, when at an altitude of 25° , was 64,700 candle-power at one metre's distance; and another time, when at an altitude of 40° , 82,000 candle-power. The apparent area of the sun's disc at this distance would be .68 centimetres; and assuming that the area of the candle flame in this instance was 2.7 centimetres, which could not be very

far out of the way, we have the intensity of the light from the sun's disc in the two instances, $\frac{2.7}{.68} \times 64,700 = 257,000$, and 326,000 instead of 53,000, times that of the candle.

In our author's observation the altitude of the sun could not have been far from 12° ; which, together with the greater clearness of the American skies, may have produced the large discrepancies in our results. But assuming my results to be correct, even at an altitude of 40° the sun gives out 33 times the light of a Swan lamp for the same amount of power expended. — W. H. P. [9]

(Photography)

Green fog.—A possible explanation of this difficulty is offered by Mr. E. Dunmore, who thinks it is due to the action on carbohc acid by ammonia, converting it into aniline. Both substances are generally present in an emulsion prepared with ammonia; and, with regard to an acid-boiled emulsion, the gelatine may of itself contain them,—the ammonia from incipient decomposition, and the carbohc acid from what has been used to preserve it from putrefaction during manufacture. — (*Brit. journ. phot.*, Dec. 1, 1882.) W. H. P. [10]

Cold emulsification.—Mr. A. F. Genlain describes his method of carrying out Mr. Henderson's formula for cold emulsification. He thinks that by discarding the carbonate of ammonia, as Mr. Henderson has since suggested, this will prove one of the most certain processes yet discovered. — (*Brit. journ. phot.*, Dec. 15, 1882.) W. H. P. [11]

A modified gelatine emulsion.—Mr. W. K. Burton employs a process by which, in the results obtained, the density of the negative will increase nearly proportionally to the amount of light received. By the ammonia process the density increases too rapidly at first, while in the long boiled emulsion the increase is too slow. But the great advantage which he claims lies in the fact that the gelatine which has gone through the ordeal of the operation necessary to obtain sensitiveness is eliminated. It is this gelatine which he thinks gives rise to many of the evil phenomena which gelatine plates exhibit, especially when ammonia is used. — (*Brit. journ. phot.*, Dec. 15, 1882.) W. H. P. [12]

CHEMISTRY.

(General, physical, and inorganic.)

Lecture experiments.—Dr. A. W. Hoffmann has devised a series of lecture experiments similar in principle to those described in his *Einleitung in die moderne chemie*. The electrolysis and formation of hydrochloric acid are illustrated in a simple manner, and several improvements are introduced into experiments illustrating the phenomena of combustion. Some experiments on the volumetric relations of gases are suggested, and the analysis of ammonia gas is made less tedious in its details. A new form of apparatus is described, which is intended to give an experimental illustration of the law of Dulong and Petit. — (*Berichte deutsch. chem. gesellsch.*, xv. 2566.) C. F. M. [13]

Lecture experiments with zinc-dust and sulphur.—In the experiment which is usually performed to illustrate chemical combination, instead of heating sulphur with copper or iron filings, Schwarz makes an intimate mixture of sulphur and zinc-dust, and ignites it with a match. It burns like gunpowder, with a bright greenish flame, leaving a residue of zinc sulphide. When heated in a retort with carbonic disulphide, zinc-dust is converted into the sulphide, and carbon separates in the form of soot. Many complex organic compounds containing sul-

phur are decomposed when heated with zinc-dust with the formation of zinc sulphide and carbon compounds of a simpler order. — (*Berichte deutsch. chem. gesellsch.*, xv. 2505.) C. F. M. [14]

Preparation of oxygen at ordinary temperatures.—When potassium permanganate is mixed with concentrated nitric acid, M. Guyard finds that oxygen is liberated from the permanganic acid with great regularity, and the action continues until two and a half equivalents are set free. If the apparatus is then immersed in boiling water, the disengagement of gas is kept up until altogether three equivalents of oxygen are obtained from the permanganic acid. — (*Bull. soc. chem.*, xxxviii. 383.) C. F. M. [15]

The double haloid salts of mercury.—For the purpose of obtaining a more definite knowledge of reactions which take place in the formation of double salts, M. Berthelot has determined the heat of formation of certain double salts of mercury. It appears that the quantity of heat liberated in the formation of the anhydrous salt is smaller than when the hydrous salt is formed: $\text{Hg Cl}_2 \cdot \text{K Cl} = +1^{\text{cal}} 9$; $\text{Hg Cl}_2 \cdot \text{K Cl} \cdot \text{H}_2\text{O} = +2^{\text{cal}} 7$. The acid salt $\text{Hg I} \cdot 2 \text{H I}$ sets free the same amount of heat as the salt $\text{Hg I} \cdot 2 \text{K I}$. While the heat of formation of the three haloid salts of potassium is nearly the same, it is very different in the corresponding salts of mercury: $\text{Hg Cl}_2 = 11^{\text{cal}} 1$; $\text{Hg Br}_2 = 15^{\text{cal}} 4$; $\text{Hg I}_2 = 21^{\text{cal}} 7$. This inequality, as the author proposes to show, is the determining cause of double decompositions. — (*Bull. soc. chim.*, xxxviii. 369.) C. F. M. [16]

METALLURGY.

New process of manufacturing aluminum.—A mixture of alum and pitch is calcined, retorted, and leached. The residue contains 84 per cent of alumina, while the old process yielded only 65 per cent. The alumina is then made into the chloride; and the chloride is treated with sodium, in the usual way, to obtain the metal. The process has been invented by Mr. James Webster of Holywood, England. — (*Eng. min. journ.*, Dec. 23, 1882.) R. H. R. [17]

Fine gold from chlorination.—Gold produced from the mines of the Canada consolidated gold mining company by Mear's chlorination process is reported to be the finest ever received by the U. S. mint. — (*Eng. min. journ.*, Nov. 18, 1882.) R. H. R. [18]

Improvements at Batopilas in silver amalgamation.—The losses of 50 oz. per ton in the tails by the old arrastras have been reduced to 8 oz. per ton. The improvements consist of pan amalgamation for the first and second class ore, concentration followed by pan amalgamation for third-class ore. The loss in mercury has been reduced at the same time from 27 per cent, as incurred by the arrastra, to $2\frac{1}{2}$ per cent with the pan. — (*Eng. min. journ.*, Nov. 18, 1882.) R. H. R. [19]

GEOLOGY.

Lithology.

Some Himalayan melaphyrs.—Col. C. A. McMahon has made a microscopic examination of certain traps regarding whose origin some doubt had been expressed. The prevailing tendency had been to hold that they were sedimentary rocks metamorphosed; but McMahon holds that his microscopic researches afford abundant proof that they are altered basaltic lavas. Two plates accompany the paper, which indicate either a very low grade of art or a very small appropriation. — (*Rec. geol. surv. India*, 1882, xv. 155.) M. E. W. [20]

Rocks classified by formations.—Prof. E. Renevier has published the following classification,

which he regards as a natural one; and, although many will not be disposed to agree with him, it contains certain elements of value.

		Clastogenous rocks.	Gravels. Breccias. Conglomerates.
Deutero-genous rocks.	{	Psammogenous rocks.	Sand. Sandstone. Quartzite.
		Ilyogenous rocks.	Earthy rocks. Schistose rocks. Lithoidal rocks.
	{	Zoögenous rocks.	Phanerozoic limestones. Microzoic limestones. Clastozoic limestones. Cryptozoic limestones.
		Microntogenous rocks.	Siliceous microntogenous rocks. Ferrugineous microntogenous rocks.
Organogenous rocks.	{	Phytogenous rocks.	Fossil resins. Bitumens. Fossil carbons.
		Halogenous rocks.	Vegetable earths. Gypseous rocks.
Hydatogenous rocks.	{	Crenogenous rocks.	Saline rocks. Incrustations. Concretions.
		Phlebogenous rocks.	Pisolites. Quartz, calcite, siderite, barite, fluorite, phosphorite, etc.
	Pyrogenous rocks.	{	Chysigenous rocks.
Athrogenous rocks.			Dioritic lavas. Volcanic breccias. Volcanic tuffas.
Crypogenous rocks.		{	Granitoid rocks.
	Crystalline schists.		Alumino-alkaline schists. Magnesian schists.

(Arch. sc. phys. nat., 1882, July 15.)

M. E. W.

[21]

(Arch. sc. phys. nat., 1882, July 15.) M. E. W. [21]

Meteorites.

The Dresden meteorites.—A. Purgold gives a list of the forty-five specimens of meteorites in the Dresden museum, adding a brief description of each specimen. Following Tschermak, the meteorites are arranged according to the following classification:—

I. Meteoric stones.

1. Anorthite and augite. Iron rarely seen. Eukrite.

2. Olivine, bronzite, enstatite. Iron rarely seen.

3. Olivine and bronzite with iron. Chondrite.

II. Meteoric iron.

4. Silicates and meteoric iron forming a granular mixture. Mesosiderite.

5. Meteoric iron porphyritically enclosing crystals of silicates. Pallasite.

6. Meteoric iron.

(Abhandl. gesellsch. Isis, 1882.) M. E. W. [22]

The Pallas iron.—Dr. Stanislas Meunier has made a recent study of a specimen of the celebrated iron olivine meteorite found by Pallas at Krasnjarsk, Siberia. He regards the structure of this meteorite as a vein-form similar to the terrestrial veins commonly known as *filons en cocardes*. The pyrrhotite in this he seems to regard as derived from the nickeliferous iron by the action of sulphuretted hydrogen. On account of this derivation, he claims that this meteorite should be separated from the others enclosed under the pallasites by Gustav Rose. — (*Comptes rendus*, xcv. 938.) M. E. W. [23]

Fusion-structures in meteorites.—In this abstract Mr. F. G. Weichmann holds that the supposed organic forms described by Dr. Otto Hahn from meteorites are 'fusion structures,' that is, formed by the cooling of the meteorite from a state of fusion. This view was taken by Prof. Kengott in 1868,

when he described these structures in the Knyahinya meteorite, the one in which Hahn found most of his so-called meteoric corals, crinoids, etc. Judging from the abstract, the completed paper of Weichmann will contain much interesting matter. — (*Trans. N. Y. acad. sc.*, 1882, i. 153.) M. E. W. [24]

METEOROLOGY.

The hurricane of Oct. 20, 1882.—The observatory of Manila has published a small monograph containing a detailed account of this disastrous storm. It is rare that a storm of this nature passes so near an observatory equipped with self-recording instruments, as in this instance. The centre of the storm moved almost exactly over Manila, which gives this report peculiar value. It contains a chart of the records of the several meteorological instruments, and diagrams illustrating the progress of the hurricane. The observations recorded as the centre of the depression was passing are especially noteworthy. The pressure experienced a rapid fall of 24 millimetres in 3½ hours, and a correspondingly rapid rise; the temperature rose from 25° to 31° C. in forty-five minutes, and fell with equal rapidity; while the relative humidity dropped from 100 to 53 per cent in the same short time, and rose again. The velocity of the wind, which was 54 metres per second (about 120 miles per hour) immediately before and after the passage of the centre, was 0 for two minutes only before the change of its direction. The diameter of the vortex was about 15 miles, and its velocity of translation 19 miles an hour. — W. U. [25]

[An abstract of the Jesuit observations with fuller details and diagrams is given in another part of this week's issue.]

Exposure of thermometers.—Experiments made by Dr. Gill at the Cape of Good Hope, with the Stevenson shelter, Glaisher stand, and a window screen, show large differences in the records of maximum and minimum temperature. An extreme difference of 9.2° is found in the annual value for 1881 of the range between the maximum and minimum readings. Experiments made by Rev. F. W. Stow, with the Stevenson and metallic shelters, favor the latter; but care was not taken to have the shelters of the same size, and the instruments similarly placed within them. There is much need of attention to the subject of uniformity of thermometer exposure, especially in this country. — (*Quart. Journ. meteor. soc.*, July, 1882.) W. U. [26]

The aurora.—M. Angot considers that the past records of auroral phenomena distinctly indicate diurnal, annual, and secular periods. His researches confirm the electrical theory of the origin of the aurora, as elaborated by Edlund. — (*Lum. électr.*, Dec. 16, 23, 1882.) W. U. [27]

PHYSICAL GEOGRAPHY.

Terraces and beaches about Lake Ontario.—J. W. Spencer continues his studies in Canada in the region of the former connection of Lakes Erie and Ontario, and finds evidence of post-glacial lake-submergence 1,700 feet above present sea-level: the Great Lakes must then have been confluent, and connected with the sea by several outlets, — St. Lawrence, Mohawk, southward from Cayuga and Seneca Lakes, and by several paths southward across Ohio. The beaches corresponding to the level of these old outlets are believed to be the most conspicuous and widespread. The 'Artemesia gravel' is regarded as a shore deposit of the subsiding lake. Shore-ice is considered an important agent in building the beaches. — (*Amer. Journ. sc.*, Dec., 1882.) W. M. D. [28]

High river terraces of eastern Connecticut.—Following the work of Prof. J. D. Dana (*Amer. journ. sc.*, x., 1875, 429), B. F. Koons explains the position of several terraces as depending on ice-dams during the decline of the glacial period. — (*Amer. journ. sc.*, Dec., 1882.) W. M. D. [29]

Southward discharge of Lake Winnipeg.—Prof. J. D. Dana decides against Winchell's and Upham's view, that the former southern overflow of Lake Winnipeg was due to a northern ice-barrier; and in favor of Warren's and G. M. Dawson's explanation by a change of level, chiefly a northern depression, because the old lake-shore is no longer level, but slopes to the north with the general slope of the adjoining plateau. — (*Amer. journ. sc.*, Dec., 1882.) W. M. D. [30]

Temperature of Wisconsin lakes.—E. M. Gifford and G. W. Peckham found a bottom temperature at 80 ft., of 42° F. through the summer and 39° or lower in the winter. — (*Trans. Wisc. acad.*, v. 273.) W. M. D. [31]

GEOGRAPHY.

(Arctic.)

Explorations in Alaska.—Drs. Arthur and Aurel Krause of the geographical society of Bremen, who undertook, under the auspices of the society, in 1881, to make explorations in Alaska and the neighborhood of Bering Strait, have returned, and made their preliminary report to the society. In the spring of 1881 they took passage on a small schooner for Bering Strait, and were landed near St. Lawrence Bay on the shores of the Chukchi Peninsula. Here they spent the summer in exploration, returning to San Francisco in autumn, and thence proceeded to Alaska. The winter was spent at a trading-post on Chilkoot Inlet at the head of Lynn Canal, in lat. 59° N., and long. 135° W. Last summer Dr. Aurel Krause returned to Germany, *via* Panama; and in October his brother followed him by way of the line of the Northern Pacific railway. They brought very extensive collections. A catalogue of the ethnologica has just been issued by the society. The natural-history material has been assigned for study by the director of the Bremen museum as follows: crania, to Prof. Welcker; echinoderms, to Prof. H. Ludwig; fish, to Dr. F. Heincke; decapod crustaceans, to Dr. F. Richters; hydroids and polyzoa, to Herr Kirschenpauer, in Hamburg; reptiles, to Dr. J. G. Fischer; Prof. Metzger takes the amphipods and isopods; Poppe, the copepods; Dr. P. C. Hoek of Leiden, the cirripeds and pycnogonida; Dr. Marenzeller, the annelids; Prof. C. Heller, the tunicates; Dr. F. Karsch, the spiders and myriapods; Dr. W. Peters, the mammals; Director Spägel, the amphibians and zephyreans; Dr. Hartlaub, the birds; Drs. Krause and von Martens, the mollusks; Dr. Aurel Krause, the fossils; while the botanical collections are divided among Drs. F. Kurtz, C. Müller of Halle, Gottsche, and Hagen. Charts of part of the west shore of Bering Strait, of the water-shed between the head of Lynn Canal and the sources of the Yukon, of the East Cape of Asia, and various harbors, have already been issued from plans by the explorers, in the *Deutsche geographische blätter*. On Nov. 4, Dr. Aurel Krause lectured before the Gesellschaft für erdkunde, Berlin, on the Tlinkit Indians of Alaska. The preparation of the final reports will naturally take some time; but the society is to be congratulated on its successful foray in a region so difficult of access, and so distant from the base of operations. — (*Deutsche geogr. blatt.*, v. 4, 1882.) W. H. D. [32]

Arctic whalefishery in 1882.—The 'catch' of

the Dundee whaling-fleet, eight steamers, amounts to seventy-nine whales, affording about nine tons of blubber each, equivalent to about 5,000 bbls. oil and 100,000 lbs. baleen. Last year, a much more 'open' season, only forty-seven whales were obtained. In the Bering-strait region, the San Francisco fleet obtained a fair reward for their exertions in the form of 21,054 bbls. oil, 313,100 lbs. baleen, and 16,600 lbs. walrus-tusks. The fleet numbers about thirty sail, and the value of the 'catch' reported is about \$960,000. The species pursued in these seas are *Balaena mysticetus* L. (*bowhead*) of the Pacific whalers, and *right whale* of the North-Atlantic whalers), and *B. Sieboldii* Gray (known as the Pacific right whale). The whalers resort to 'walrusing' in Bering Strait in default of whales; but in good seasons little walrus-oil is taken, and most of the tusks are purchased by barter from the natives of the region. — W. H. D. [33]

(Africa.)

German exploration in Africa.—In the past nine years, the German African association has sent six expeditions to the Kongo region, at a total cost of £22,000. The first, under Güssfeldt (1873-76), went to the Loango coast, north of the Kongo. Although not penetrating far into the interior, this trip alone cost £10,500. All the other expeditions entered at S. Paolo de Loanda. Pogge (1875) advanced 700 miles eastward to Kawenda, the chief town of a region as large as Germany, ruled by the Muata Yanvo (king) named Shanama. Mohr died at Malandje, the most advanced Portuguese trading-station, 200 miles from the coast. Schütt (1877-79) reached the Chikapa River, 500 miles inland. Buchner (1879-80) went also as far as Kawenda, staying there six months; and on returning early in 1881, met at Malandje the latest expedition, still in the field, under Pogge and Wissmann. Finding the road to the Muato Yanvo's town (Kawenda) closed on account of his difficulties with the neighboring and aggressive Kioko, Pogge and Wissmann turned north-east, and were last heard from among the Tushilange people, at the towns Mukenge and Kingenge, on the river Ruru (Lulua). They intended going on past Lake Mukamba to Nyangwe, on the Lualaba (Lualaba), lat. 4½° S., long. 26½° E., whence Wissmann was to proceed to the east coast if possible, and Pogge would return westward. [Wissmann arrived at Zanzibar last November.]

The region consists of three physical divisions: the littoral slope, barren and dry, with short rivers running westward; the mountain belt; and the southern part of the Kongo basin, of undulating or hilly surface, well wooded or grassy, cut by very numerous rivers generally running northward, and nearly all with the syllable Lu, Ru, or Ku in their names. This district has a rainy season from September to April, with a temperature from 63° to 81° F. The dry season is occasionally as cool as 45°. The hippopotamus is the only large animal seen; other large game is very scarce. — (*Proc. geogr. soc. Lond.*, Nov., 1882, map.) W. M. D. [34]

Upper Senegal and Niger.—Commandant Galien was charged by the Governor of Senegal, in 1880, with a mission of exploration in western Soudan, and with powers of treaty to induce the Sultan Ahmadou of Segu to place the Niger within his dominions under French protection. The expedition left St. Louis, Jan. 30, 1880, and began its work of exploration beyond Bafulabe, where the Senegal branches, on March 30 following. Ascending the Ba-khoy branch, the village chiefs accepted French protection; and by Mount Kita a fort was built to serve as an advanced outpost. Here the party divided; Lieut.

Vallière going by Murgula and Kumakhana, and Gallieni crossing eastward to the Ba-ule, to meet again at Bammako on the Niger. Vallière accomplished his journey successfully; but the commandant was attacked at Dio, on May 11, by 1,500 Bambaras, and after a hard fight and heavy loss escaped, leaving his supplies, and joined Vallière as planned. Then crossing to the right bank of the Niger, the whole party descended toward Segu, but were detained at Nango, some leagues from the capital, for ten months, by order of the Sultan. Here they suffered greatly from privation and fever, till at last, concluding a favorable treaty with the Sultan after many *palabras*, they turned back March 21, 1881, returning as Vallière had entered, and reaching St. Louis on May 12. The country was found to be but moderately mountainous: the highest point was by Kumakhana, 750 met., the divide here between the Ba-khoy and Niger being 450 met. The Niger, where followed, was about 300 met. above sea-level. The rainy season lasts from June to December, the rest of the year being dry. Many details are given concerning the best routes for road-construction into the interior. — (*Bull. soc. géogr. Paris*, map.) W. M. D. [35]

Expedition to the Kuengo.—This westernmost of the large southern branches of the Kongo has been visited by v. Mechow between lats. 5° and 8° S. He entered and returned by S. Paolo de Loanda. On reaching the river, he descended it to within about 100 miles of its junction with the Kongo, when he was obliged to return by the fear his men felt for supposed cannibals beyond. The river was 1,000 to 1,800 paces broad, enclosed by luxuriant forests in a well-marked valley. Von Mechow returned to Germany early in 1881. — (*Verh. gesellsch. erdk. Berlin*, ix, 1882, 475.) W. M. D. [36]

Reported lake west of Albert Nyanza.—Mr. F. Lupton, governor of the Egyptian province Bahr el Ghazal, writes on July 27, 1882, of the reported existence of a great lake, as large as Victoria Nyanza (Ukerewe), about lat. 3° 40' N., long. 23° E. The Barboa people, living on its eastern shores, are said to make a three-days' voyage across the lake, and obtain from the tribes on the western side beads and wire of European make. Mr. Lupton thinks the Uelle flows into this lake, and that its outlet joins the Kongo. — (*Proc. geogr. soc. Lond.*, Nov., 1882.) W. M. D. [37]

BOTANY.

(*Structural and physiological.*)

Chemical character of living protoplasm.—In 1881 Loew and Bokorny published an interesting paper on the effect produced by very dilute solutions of gold and silver on living cells. The protoplasm soon becomes distinctly colored by reduced gold or silver, whereas dead protoplasm gives no such reaction. The present paper by the author first named adds a few details, and attempts a fuller explanation of the phenomena. A single milligram of a salt of silver or gold is dissolved in a litre of water; and the minute object—for instance, a few threads of a filamentous Alga—is placed in the whole amount of liquid. The reactions described by the authors are not seen when the object is treated with the reagents in a more concentrated form, or in a smaller quantity of liquid. Under conditions wholly favorable to the reaction, the protoplasm becomes tinged with faint color in a short time. When, however, a cell containing protoplasm which has been destroyed by chemical or mechanical means is subjected to the same conditions, no change of color is observable. The reaction is assumed to be due to the presence of one or more members of the aldehyde group in the living proto-

plasm. The authors call attention in their first paper to the singular fact that certain Algae failed to give this reaction. — (*Bot. zeit.*, Dec. 1, 1882.) G. L. G. [38]

Some leaf-movements and light.—To express the greater longitudinal growth upon the upper than the lower side of a part, by which the part bends downward, the term *epinasty* has been used. Detmer, by experiments on germinating plants, has become convinced that the epinastic movements of leaves are wholly dependent on light; and he proposes a new term, *photo-epinasty*, in part place of the older one. — (*Bot. zeit.*, Nov. 17, 1882.) G. L. G. [39]

Epinasty of leaves, according to E. Mer, from the more rapid development of the palisade cells of the upper surface under the influence of light. — (*Comptes rendus*, Dec. 11, 1882.) G. L. G. [40]

Development of pollen in cycads and conifers.—By Jurányi: in part, a reply to Treub of Buitenzorg (Java). The formation of the pollen in *Abies* and *Pinus* is almost precisely that of the cycads. — (*Bot. zeit.*, Nov. 24 and Dec. 1, 1882.) G. L. G. [41]

Colors of flowers, and light.—According to Schnetzlar, the blue coloring matter in the corolla of *Platycodon grandiflorum* can be seen to come from the breaking-up of chlorophyll granules pre-existent in the cells. The blue nectaries develop their color even in unopened flowers, and therefore in partial darkness; but the upper part of the ovary becomes blue only in full light. — (*Arch. sc. phys. nat.*, Nov. 15, 1882.) G. L. G. [42]

Colors of flowers.—Dr. Müller, in reviewing the subject of floral colors from a biological standpoint, gives abstracts of the contributions to our knowledge of their uses. Readers who confine themselves chiefly to books and papers published in the English language will find that much of what they have been accustomed to treat as original with some of our favorite writers, on the inter-relations between flowers and insects, is here traced to the earlier contributions of German investigators. — (*Kosmos*, 1882, 117.) W. T. [43]

Floral forms.—In his 'Across lots,' Mr. Gibson gives us a little pleasantly written philosophizing suggested by the variety in the forms of flowers. — (*Harper's mag.*, Nov., 1882.) W. T. [44]

Season of flowering.—Australian acacias, transplanted across the equator into northern India, have been found to gradually adapt their time of flowering to the changed springtime of their new home. For about twenty years, according to Dr. Brandis, no change was noticed; but since it began they have bloomed earlier each successive year until now, twenty years later, they bloom in June instead of October. — (*Indian forester*, 1882.) W. T. [45]

(*Systematic.*)

American asclepiads.—Fournier begins an enumeration of the Asclepiadaceae of America, excluding for the most part the United States and Brazil, with notes and descriptions of some new genera and species. — (*Ann. sc. nat.*, 1882, 364.) S. W. [46]

Indian species of Primula and Androsace.—Professor G. Watt describes and figures twenty-four species of *Primula* and six of *Androsace* from the Himalaya, most of them new or previously undescribed. The paper has undergone revision by Sir J. D. Hooker, and includes notes on the geographical distribution of *Primula*, remarkable inasmuch as the nearly one hundred species are confined to the temperate and cold regions of the northern hemisphere, with the exception of a single species that abounds in Fuegia and the Falkland Islands. — (*Journ. Linn. soc. Lond.*, Dec., 1882.) S. W. [47]

Lythraceae.—Continuation of Koehne's monograph, comprising the genera *Decodon*, of a single North American species (*D. verticillatus*, Elliott), *Grislea*, *Adenaria*, *Tetrataxis*, and *Ginoria*,—the first two perhaps to be united to *Heimia*, and the last including *Antherylium*.—(*Engler's bot. jahrb.*, Oct., 1882.) s. w. [48]

(*Fossil plants.*)

Heer's Flora fossilis arctica.—The second part of the sixth volume of this celebrated work describes plants of two stages of the cretaceous of Greenland,—those of the schists of Come, referable to the lower cretaceous; those of the schists of Atane, upper cretaceous, including a few species from Pattook, a higher member of the formation of Atane. The publication of the tertiary plants of the same country is reserved for the third part of the volume, the plates being already prepared. All these plants have been described from specimens obtained by the Swedish geographical and geological survey of Greenland under the direction of Steenstrup. And such a degree of attention has been given to paleontological researches by the assistants of the survey, that twenty-five large boxes of specimens of fossil plants were sent to Heer.

The flora of Come, composed of 86 species, has 42 species of ferns, 1 *Marsilia*, 1 *Lycopodium*, 3 *Equisetaceae*, 10 *Cycadeae*, 21 conifers, 5 monocotyledons, 1 dicotyledon only, and 2 *Carpolithes*. The flora of Atane, composed of 177 species, has 3 fungi (*Hypoxyleae*), 34 ferns, 1 *Marsilia*, 1 *Selaginella*, 1 *Equisetum*, 6 *Cycadeae*, 26 conifers, 8 monocotyledons, and 97 dicotyledons. These two groups of floras of the cretaceous are remarkably different in their composition and in their characters. Besides the great proportional disparity in the number of their representatives, in divers classes of the vegetable kingdom, there is as marked a difference in the characters of the species. While Atane has 97 dicotyledons, Come has only 1, a *Populus*, represented by a few fragments of leaves; and of the whole number of described species, only 7 ferns, 1 *Equisetum* and 6 conifers are common to both floras of Come and Atane. This last series of plants shows a greater degree of relation to the flora of the Dakota group: for we find in common to them, 2 ferns, 3 conifers, 1 or 2 cycads, and 8 dicotyledons; and also, the same degree of analogy is remarked in the animal fossil remains found in strata above the schists containing vegetable remains at Atane, and of which some species have been recognized by M. Lortol as identical with those of the Fox Hill group of Hayden, like *Avicula nebrascensis* Evans, *Solemya subplicata* Meek and Hayden, *Hemister Humphriesianus* Meek. — L. L. [49]

ZOOLOGY.

(*Geographical distribution.*)

The Sonoran region.—In continuation of an argument upon the desirability of uniting the nearctic and palaearctic zoölogical regions, Prof. Heilprin stated his reasons for separating the Sonoran region (the south-western portion of the United States, and the Mexican state of Sonora) from the rest of North America, and uniting it with the neotropical or South-American region. The reptiles and batrachians, especially of the smaller district, were sharply distinguished from those found to the north and east, and allied to the southern forms.

Dr. Horn stated that the coleopterous fauna of the Sonoran region was, on the contrary, more closely allied to that of the rest of North America. — (*Acad. nat. sc. Philad.*; meeting Jan. 2.) [50]

Zoölogical geography of western North Amer-

ica.—Prof. E. D. Cope presented for publication a paper entitled: Notes on the geographical distribution of Batrachia and Reptilia in western North America. The communication is based on collections made by the author and his assistants at various points in the Rocky-Mountain and Pacific regions during the last ten years, and is an important contribution to the final definition of the zoölogical provinces and districts of the continent.

The results to zoölogical geography obtained by the identification of species contained in the collections are as follows: The extension northwards of the range of *Crotalus molossus*, *Stenostoma dulce*, *Diadophis regalis*, *Crotalus lepidus*, and *Holbrookia texana*; the extension to the Rocky Mountains of the range of *Spea hammondi*; the discovery of a new *Scaphiopus* in the Great-Basin district; and of the southern extension of *Rana pretiosa* into the same. It has also been determined that the North-Pacific fauna extends east to the Rocky Mountains. This fauna is especially represented by *Bascanion vetustum*, *Rana pretiosa*, and *Bufo columbiensis*. The Great-Basin district of the Sonoran fauna extends north to the southern slope of the Rocky Mountains in Idaho, where are found several of its species. The same fauna extends north along the eastern slope of the Sierra Nevada, to the beginning of Surprise Valley, California. The North-Pacific fauna extends from Surprise Valley, Eastern California, northwards as far as the author's explorations have extended; viz., to Silver Lake and Klamath Lake. A wide southern range for *Spea hammondi* and *Bufo columbiensis* was also determined.

These results indicate that the Pacific region has much greater extension eastward than has been supposed, although foreshadowed in Mr. Cope's paper on the zoölogy of Montana, published in 1879. They also indicate that the region must be divided into three districts; for which the names Idaho, Willamet, and South-Californian are proposed. The first is characterized by the absence of *Gerrhonotus*, and of certain species of *Amblystoma* and *Cynops*. The South-California is characterized by the presence of *Rhinophilus*, and absence of *Amblystoma*. It is allied to the Sonoran region, to which it is adjacent. — (*Acad. nat. sc. Philad.*; meeting Jan. 9.) [51]

Protozoa.

Perception of light by low organisms.—Th. W. Engelmann has published some interesting observations on this subject. He maintains that light acts in three fundamentally different manners: 1. Directly, by alteration of the exchange of gases, without demonstrable addition of sensation; 2. Alteration of the sensation of the respiratory needs, consequent upon alteration in the gaseous exchange; 3. By means of a specific process assumably corresponding to our sensation of light. By ingenious arguments he seeks to prove that *Navicula* is a type of the first, *Paramecium bursaria* of the second, and *Euglena viridis* of the third. As regards the last he says that the seat of the perception of light is exclusively in the anterior end of the body, where there is no chlorophyll. — (*Pflüger's arch.*, xxix. 387.) c. s. m. [52]

Bütschli's Protozoa.—Parts 14–16 of Bütschli's invaluable revision of the Protozoa in Bronn's *Klassen und Ordnungen des thierreichs* has just appeared. The plates (xxii.–xxviii.) refer to the Radiolaria; the text is entirely devoted to the Gregarinidae, which are nearly completed. It is hardly possible to estimate this work too highly; for there are no other animals concerning which so many errors have been current in recent years as the Protozoa, and it cannot fail to advance zoölogy to have them treated by so

able and competent an investigator as Prof. Bütschli. It is one of the few works that may be fairly termed indispensable to the microscopist and zoölogist. (It is stated from a competent private source that probably two years will be needed to complete the undertaking.) c. s. m. [53]

Mollusks.

History and distribution of the fresh-water mussels.—Under this title Dr. R. E. C. Stearns prints a suggestive paper, read before the California academy of sciences, Nov. 20, 1882. The geographical distribution, geological history, and principal subdivisions of the Naiades are summarized, and the species of the great basins and the Pacific slope subsequently taken up in more detail. *Anodonta Nuttalliana*, representing four nominal species, described twenty-five years ago by Dr. Isaac Lea, from the Wahlamet River of Oregon, has been traced over an immense area, including the drainage system of the Columbia, the valley of California, the lakes of the eastern slope of the Sierra Nevada, thence, either recent or recently fossilized, across the desert to the Wahsatch Mountains, northward to the southern boundary of Idaho and Oregon, along the meridian of 110° W., through part of Montana, to British Columbia, and southward to Fort Yuma. They are found on the surface of the desert, and even, with other still recent species, at a depth of at least fifty feet below the surface. Some of the species have been supposed to be extinct; and in regard to *Tryonia*, announced by Mr. Tryon in 1873 as found in the living state in Utah by Wheeler's expedition (two specimens), further confirmation seems desirable before it can be confidently claimed as still inhabiting the region. The general uniformity of mollusk-fauna over this region at one time is, however, sufficiently evident. Dr. Stearns traces variations perpetuated by natural selection during the changes brought about in the region by important geological and climatic changes; the radiating distribution from higher altitudes to lower, as the land rose and the waters receded; and the missing links in the chain of migration arising from areal desiccation. He ascribes to the period immediately preceding the glaciation of the higher regions of this area, meteorological conditions more favorable to distribution of aquatic life than any since obtaining there. The author then discusses the circumboreal distribution of four or five species of *Limnaea*, *Physa*, etc., and of the fresh-water pearl mussel (*Margaritana margaritifera* L.), which exhibits some remarkable characteristics in its range. The latter is eaten by the McCloud-River Indians, and by some Oregonian tribes. He concludes, with Wetherby, that the earliest fresh-water forms were lacustrine; and the paper closes with references to the comparative antiquity of *Unio* and *Anodonta*, and a list from Lea's synopsis of the number of species of Naiades. — W. H. D. [54]

Studies of the Italian cretaceous fossils.—Under the auspices of the Accademia dei lincei, Professor G. Seguenza has just published a valuable memoir on the middle cretaceous formation of southern Italy. Already well known by his valuable contributions to our knowledge of the tertiary strata of the two Sicilies, and especially of Calabria, the present publication can only add to his reputation. The first part discusses the sufficiently simple geology of this formation; the second is devoted to the fauna, which is illustrated by sixteen quarto plates beautifully drawn by the author. Of the 223 species described in this work, 104 are supposed to be new, and 186 are mollusks. There are fish remains of two

species, twelve echinoderms (of which nine belong to the genus *Hemiaster*), and only four corals. Only one brachiopod, a *Discina*, was collected. Of true mollusks twenty are cephalopods, and fifteen gastropods, leaving, as is evident, the majority lamelli-branchiate. In fact, the characteristic feature of the fauna is that it is chiefly composed of bivalve shells belonging to the Veneridae, Venillidae, Crassatellidae, Cardiidae, Arcidae, and the great heteromyarian group of mussels and oysters. The new genus of Corbulidae (?), *Coquandia*, is described from internal casts (a condition very general among these fossils), and appears to have somewhat resembled *Eucharis* Recl., but with the cardinal tooth in each valve prodigiously enlarged, flattened, straight, and set at right angles to the margin. — W. H. D. [55]

Insects.

North American Coleoptera.—A record of coleopterology for 1881 and 1882 was presented for publication by F. G. Schaupp. The only foreign descriptions of N. A. beetles were an *Oedionychis* by Harold, a *Triarthron* by Schaufuss, a *Cymatodera* by Gorham, six *Elateridae* by Candèze, and some fifty *Dytiscidae* by Sharp. — (*Brookl. ent. soc.*; meeting Jan. 6.) [56]

Extension of the theory of mimicry in butterflies.—Mimicry of one butterfly by another widely differing from it in structure was explained by Bates as resulting from some special protection of the mimicked form, as, by distastefulness. Recently some cases have occurred in which both genera involved were similarly protected; and Fritz Müller attempted to explain this by showing how it was advantageous for one species to resemble another which is more abundant in individuals, although both may possess qualities distasteful to those creatures which would otherwise devour them. Distant objects to this extension of the theory; and adduces in support Spalding's experiments upon young turkeys bred in confinement, who showed instinctive alarm of sting-bearing insects. Meldola here comes in, and takes up the question of whether birds have an hereditary distaste for nauseous insects, or learn of their nastiness from sad experience. He claims the latter, while Distant replies in favor of the former view. The discussion partakes somewhat of a polemic character, and is rather barren considering our ignorance of the facts in the case: when they disagree as to which is the mimicking and which the mimicked form, philosophizing is somewhat out of place; yet some suggestions worthy of being kept in mind are made by both parties. — (*Ann. mag. nat. hist.*, Dec., 1882, and Jan., 1883.) [57]

A carnivorous bee.—P. Parfitt captured on the wing a male *Halictus* with its mouth full of insects; viz., a fly, a larval homopteron, and several plant-lice. — (*Ent. monthl. mag.*, No. 223.) [58]

VERTEBRATES.

Origin of the hypoglossus and morphology of the head.—Perhaps the most interesting and important discovery in embryology made recently is that of the nature of the hypoglossal nerve by Dr. August Froriep. This investigator found, in ruminant embryos, evidences of three distinct proto-vertebrae in front of the first spinal or cervical nerve, and behind the vagus. In front of each of these is a distinct set of anterior nerve roots, which all unite into a single trunk, — the hypoglossus. Over the posterior of these sets of roots is a dorsal ganglion, which also unites with the same nerve, and resembles the spinal ganglia in position and shape, although smaller in

size. The hypoglossus must therefore be considered to have been formed by the fusion of at least three spinal nerves. As is well known, it makes its exit through the occipital bone, which must therefore be regarded as formed by the fusion of several vertebrae. This, again, forces us to the conclusion that the skull is not identically composed in all animals, but that in the mammals portions of the primitive cervical region have been added to the head, the portions thus added being the hypoglossal region.

At present, therefore, we must consider the head as made up, in mammals, of three divisions: 1°, the preputillary or trabecular region, bearing the nose and eyes, and corresponding to the upper face; 2°, the pseudo-vertebral region, which gives off the nerves, namely, trigeminal, facial, glosso-pharyngeal, and vagus, supplying the visceral arches or pharyngeal clefts. (The vagus, as is well known, is supposed to be the product of the fusion of several nerves.) 3°, the vertebral region, that of the occipital bone and hypoglossal nerve. This is an entirely new start in the interpretation of the morphology of the head.

The ganglion of the hypoglossus is not permanent. It is always smaller than the spinal ganglia, but for a while it enlarges with the growth of the embryo; it then remains stationary, and becomes finally atrophied. Dr. Froriep's clear and concise presentation of his subject, and his philosophic grasp of its far-reaching conclusions, as well as his modest tone, deserve high praise. His short article should be familiar to every morphologist. His observations were made principally on sheep embryos, and by means of longitudinal sections. Embryos of from 8 to about 18 mm. long show the development of the hypoglossus. — (*Arch. anat. physiol., anat. abtheil.* 1882, 279) C. S. M. [59]

Origin of the vertebrates. — Mr. C. O. Whitman described a rare form of the blastoderm of the chick, in which the primitive groove extended to the very margin of the blastoderm, terminating here in the marginal notch first observed by Pander. The blastoderm was eighteen hours old, and nearly one centimetre in diameter. The extension of the primitive groove to the marginal notch was regarded as a reappearance of a developmental feature, which is constant in some of the lower vertebrates and their nearest invertebrate allies, but which has ceased to be a normal occurrence in the development of the chick. The blastoderm, interpreted as an atavistic form, was held to be an important confirmation of the theory put forward by His and Rauber, according to which the vertebrate embryo arises by concrescence of the two lateral halves of the germ-ring. The objections made to this theory by Balfour were reviewed, with a view to showing that they presented no serious difficulties to the acceptance of the concrescence theory. Mr. Whitman maintained that Balfour's objections were not broad enough to cover his own theory of the origin of the vertebrates from annelids, — a theory which gave us a right to expect some fundamental agreement in their modes of development. This agreement, he contended, was seen, first, in the origin of the embryo from a germ-ring, by the coalescence of the two halves along the axial line of the future animal; and, secondly, in the metameric division, which followed in the wake of the concrescence. The theory of the annelid origin of the vertebrates was inconsistent with the denial of the concrescence theory, since concrescence of the germ-bands is a well-established fact for both chaetopods and leeches. The theory of differentiation set up by Balfour in opposition to that of concrescence entirely

ignored the annelids, and offered no explanation of the uniform relations of the embryo to the germ-ring. — (*Bost. soc. nat. hist.; meeting Jan. 3.*) [60]

Fish.

Use of the saw in *Pristis*. — In presenting the beak of a saw-fish (*Pristis*) from the Lake of Bay, Philippine Islands, Dr. S. Kneeland suggested a use for this toothed projection, in this specimen thirty-three inches long, which seems more reasonable than the ones usually given; viz., that it is an instrument for more or less horizontal insertion in the mud or sand of shallow waters, which, by a vigorous sweep of the long upper-lobed, shark-like tail, is quickly pulled out backward. The lateral teeth are sharpened in front for easy insertion, but concave behind to offer resistance, and more thoroughly stir up the bottom; this action is doubtless accompanied by a series of short horizontal movements of the anterior part of the body. The mouth is small, underneath, with pavement-like teeth, as in the rays, adapted for crushing the mollusks, crustaceans, and hard-cased creatures on which it feeds. He thinks the stories of its attacking in open sea the smaller cetaceans are errors of observation, arising from confounding the saw-fish with the sword-fish (*Xiphias*); neither its weapon, its mouth, its teeth, its habitat, nor its habits, can be reconciled with the active carnivorous propensities ordinarily ascribed to it. Ray-like, it is a bottom feeder, with crushing and not tearing teeth: the snout is too blunt for piercing, and its lateral teeth would be an impediment rather than an advantage. — (*Bost. soc. nat. hist.; meeting Jan. 3.*) [61]

Digestion in fishes. — Charles Richet finds in cartilaginous fishes of the genera *Scyllium* and *Acanthias*, that the gastric secretion is extremely acid and contains pepsin. This pepsin differs from that of the warm-blooded animal in that it acts as well at 20° C. as 40° C., and for its best activity needs a much more acid medium. There is no trypsin in the gastric secretion, though this has been found in other fishes. As regards the pancreas, Richet comes to direct issue with Krukenberg, who states its secretion in these fishes contains trypsin but no amylolytic ferment. — (*Archiv. de physiol.*, x. 1882.) H. N. M. [62]

Reptiles.

Fangs of the rattlesnake. — Dr. Leidy exhibited a series of fangs obtained from a rattlesnake fifty-two inches in length. The rapidity with which the functional fangs are reproduced was indicated by the presence, on each side of the jaw, of five fangs in varying degree of development, so placed as to replace those which are lost. — (*Acad. nat. sc. Philad.*, viii. *meeting Jan. 2.*) [63]

Birds.

An hermaphrodite bird. — The subject of this paper by Mr. Jeffries is a green-tailed towhee from Colorado. On dissection the bird was found to possess a normal ovary and duct on the left side, and a normal testicle and vas deferens on the right side. Owing to the early time of capture, and to insufficient means of preservation, the presence or absence of spermatozoa could not be affirmed. The kidneys of the bird showed slight anomalies. The plumage was that of a female. — (*Bull. Nutt. ornith. club*, viii. No. 1.) J. A. J. [64]

Peculiar air-sacs. — M. Boulart has found a pair of air-sacs which lie on the sides of the neck, and communicate with the nasal cavity, in *Leptoptilus crumiferus*, *Ciconia alba*, *Mycteria australis*, and *Sula bassana*. In these cases there is no communication with the air-sacs supplied by the lungs. In

a species of hornbill, similar sacs are found, but in communication with the lungs, — sacs supposed to be filled by strong expiration, and resultant increase of pressure in nasal cavity. — (*Journ. de l'anat. physiol.*, No. 5, 1882.) J. A. J. [65]

Mammals,

Measurement of the quantity of blood in living mammals. — For this purpose Gréhant and Quinquaud employ a method which essentially consists in letting the animal for some time respire a gaseous mixture containing a known and not fatal proportion of carbon-monoxide. At the end of the time the residual gas is analyzed, in order to find the amount of carbon-monoxide which has been absorbed. A specimen of blood is also drawn from the animal, and the quantity of carbon-monoxide in it determined. The ratio of this quantity to the total amount of the gas absorbed is then assumed to be the ratio to the whole blood of the quantity of blood from which the gas was extracted. Their results as to the quantity of blood in the body agree closely with those of previous workers. — (*Journ. de l'anat. physiol.*, 1882, No. 6.) H. N. M. [66]

Histology of the pancreas. — In the transactions of the university of Kieff, vols. xi. and xii., for 1881, and vol. i., 1882, W. Podwyssotzki, jun., published an extensive Russian memoir on the structure of the pancreas. The research was carried out in Peremeschko's laboratory at Kieff. The author has just published a German abstract. The secretory cells consist of two zones: a peripheral, with all the characteristics of an albuminoid body, and a central granular zone. In the cavity of the alveoli, the ducts, and the fluid of the gland, the granules are wanting. The granules of the central zone are not pure albuminoid, nor identical with the usual granules of protoplasm; they may be considered the material substratum of the trypsinogen or pancreatic zymogen. The intracellular network (Ebner, Boll) does not exist during life, there being a fluid intercellular substance which may be coagulated like a network by hardening agents. The intercellular spaces are connected with the secretion probably by receiving the transuded fluids from the capillaries. There are peculiar branching, anastomosing, wedge-shaped, connective tissue corpuscles inside the *membrana propria*. The plate-shaped processes of the centro-acinary cells extend into the intercellular spaces. Both these and the wedge-shaped cells are metamorphosed connective (not epithelial) cells of the finest ducts. The intercellular fissures, as far as the processes of the centro-acinary cells extend, are the anatomical beginnings of the ducts, which do not therefore arise in special canals or capillaries (Gianuzzi, Saviotti). The *membrana propria* is composed of connective fibres, forming a thick and fine network, and contains no cells or nuclei, and sends no processes into the interior of the alveoli. — (*Arch. mikr. anat.*, xxi. 765.) C. S. M. [67]

Abnormal dentition in dog and man. — Mr. Jacob Wortman called attention to the presence of a third true molar in the upper jaw of a skull of *Canis lupus* from Sweden. He considered it a case of partial reversion to a more generalized type, such as *Amphicyon*, where three molars exist both in the upper and lower jaw, and believed that it furnished a hint as to the probable origin of the genus *Canis*.

Dr. J. Leidy described a case of abnormal dental development in an adult man. Although the jaws were well formed, they contained only one incisor, one canine, two premolars, and one molar, on each side. Usually when a tooth is absent, and there is

no evidence of its having been extracted or lost, it has probably been retained embedded in the jaw; but in the case described no germs of the lacking teeth existed. — (*Acad. nat. sc. Philad.*; meeting Jan. 9.) [68]

Anatomy of the Aeluroidea. — St. George Mivart occupies sixty pages with notes on this group, in support of the classification proposed by him in a former memoir. The osteology is dwelt upon at length, and two very extended tables of skeletal proportions are given. — (*Proc. zool. soc. Lond.*, 1882, 459.) F. W. T. [69]

A monstrous orang. — W. A. Forbes describes an abnormal *Pithecia satanas*, having the third and fourth digits of both mani webbed to the tips. — (*Proc. zool. soc. Lond.*, 1882, 442.) F. W. T. [70]

Direct communication between the median vaginal cul-de-sac and uro-genital canal in marsupials after parturition. — J. J. Fletcher found such communication in two nearly adult females of *Osphranter robustus*, five of *Halmaturus ruficollis*, and nine of *Petrogale penicillatus*. In two small specimens of *O. robustus* and two of *P. penicillatus* it did not exist. — (*Proc. Linn. soc. N. S. Wales*, vi. 1882, 796.) F. W. T. [71]

Mammals of north-eastern New York. — Dr. Merriam enumerates 42 species of mammals for the Adirondack region, including *Phoca vitulina*, and gives many original notes on the habits of fifteen carnivores. — (*Trans. Linn. soc. New York*, i. 1882, 27.) F. W. T. [72]

PHYSIOLOGICAL PSYCHOLOGY.

The time of apperceiving simple and compound concepts. — With the eyes of the observer directed into a dark chamber toward a Geissler tube, the time from the electric illumination of the tube to the instant of closing a key was measured by Dr. M. Friedrich for four observers as the simple reaction time; the additional time required to distinguish colors in this light, to read figures and determine the number of dots irregularly disposed, was then measured. It was found that numbers of two and three figures were apperceived quicker than those of one or four or more, a notable increase of time being required to apperceive the fourth figure. If, however, the first two figures were 18, they were more quickly perceived than any others, being more familiar as designating the present century. — (*Philos. studien*, i. 1.) G. S. H. [73]

Psychological methods. — W. Wundt gives the following: 1°. The psycho-physic method, the accuracy of which has lately been questioned, but which Wundt concludes to be valid, save when applied by averaging right and wrong cases, where more thorough tests than Fechner or any of his successors have applied are needed. 2°. The method of analysis of sense-perceptions is made to include (a) composition, e.g., Helmholtz's combination of simple tones into timbre; (b) decomposition, e.g., Weber's space-threshold; (c) variation, e.g., stereoscope, judgment of broken and unbroken lines. 3°. Method of measurement of psychologic time, by reaction, comparison, reproduction, and complication. — (*Philos. studien*, i. 2.) G. S. H. [74]

The time-sense. — Two metronomes were allowed by J. Kellert to tick twice, one after the other. The pendulum of one remaining constant, that of the other was then gradually lengthened or shortened till the observer noted a difference in the interval between the ticks of the latter and those of the

former. Seven intervals of the normal metronome from 0.4 to 1.5 seconds were studied. The result showed that the indifference point at which the judgment accorded most accurately with the time of sensation was 0.755 seconds. Intervals less than this were overestimated, those greater than it underestimated. — (*Philos. studien*, ii. 1.) G. S. H. [75]

EARLY INSTITUTIONS.

Universities.—On taking the rectorship of the University of Greifswald, Professor Dr. Behrend describes briefly the beginning and growth of universities: the origin of different faculties (medicine, from Salerno; law, from Bologna; theology and philosophy, from Paris); constitutions; relation with the state, and so on. — (*Deutsche rundschau*, Dec., 1882.) D. W. R. [76]

English surnames.—Dr. Beddoe, F.R.S., considers them from an ethnological point of view. Large proportion of Norman names among the peers; Saxon names among the small land-owners and yeomen; nothing like a complete amalgamation of blood be-

tween the upper and lower classes. Probably a tenth of the inhabitants of the British Isles bear names of the Celtic-Irish type. Several other conclusions are reached. — (*Journ. anthropol. inst.*, xii. 2.) D. W. R. [77]

Agrarian institutions.—Professor Hanssen continues his studies of land-holding and agriculture among the early Germans. Certain heads of families joined together in clearing a tract of land. Upon this they took house-lots (permanent holdings) and arable lots (shifted from one part of the clearing to another, according to the field-grass system). The house-lots were held in severalty, the rest of the land in equal, but undivided shares. This was the primitive agricultural community. It is assumed by Professor Hanssen to have been an association of land-owners. We would suggest that it is an open question whether it was an association of land-owners, or an association of tenants. — (*Zeitsch. gesamm. staatsw.*, 1882, 3, 4.) D. W. R. [78]

Medieval formulae.—The "Monumenta Germaniae historica. Leges V. Formulae. Pars pri. 4to. 1882," has appeared. — D. W. R. [79]

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Smithsonian institution.

Telegraphic announcements of astronomical discoveries.—Arrangements having been completed with the director of the Harvard college observatory for conducting the system of telegraphic announcements of astronomical discoveries, which was established by this institution in 1873, correspondents are informed that hereafter the American centre of reception and distribution of such announcements will be the Harvard college observatory, Cambridge, Mass., to which address all astronomical telegrams should in future be sent. It is hoped and believed that this transfer of a highly important service will prove beneficial to the interests of astronomical science.

National museum.

The museum cases and stands have been recently examined, with a view to adoption, by gentlemen from Richmond college, Cornell university, and the museum of hygiene connected with the United States navy.

Recent additions.—A large collection of remains of the Arctic sea-cow (*Rhytina gigas*), including eleven skulls more or less perfect, has been recently received from Dr. Leonard Steineger, collector for the Smithsonian institution, at Bering Island. The specimens were accompanied by two skulls of ziphioid whales, and some valuable bird-skins. Nineteen car-loads of specimens have been received from the late Permanent exhibition in Philadelphia.

Cast of a whale.—A cast of a humpback whale has just been completed. It represents a young female, 32 feet 5 inches long, which was captured at Provincetown, Mass., about three years ago. The cast shows one-half the exterior. In the concavity, which is painted black, the skeleton is mounted in its natural position. The work has been done by Mr. Joseph Palmer.

Preparation for the fisheries exhibition.—A large number of objects have been added to the collection illustrating the fisheries, for exhibition in London in April. A model of an undisturbed oyster-bank and of one overdrilled are being prepared under the su-

pervision of Lieut. Winslow. One of the museum preparators is in New Haven, engaged in making, under the direction of Mr. Emerton of Yale College, a model of a giant squid. Five relief-models, representing the entire Atlantic coast of the United States, are in course of preparation by the U. S. coast survey, at the expense of the U. S. fish commission. Those representing the Gulf of Maine and the Gulf of Mexico are completed. The latter was exhibited by Professor Hilgard at the recent meeting of the National academy. The isobathic lines are shown in the same manner as the contour lines of the geological relief-maps. The models are prepared by Mr. C. Lindenkohl. Mr. Henry W. Elliott and Capt. J. W. Collins have prepared a series of drawings of fishing-vessels in action. They are probably the most accurate drawings of this nature ever produced, and are worthy of study by artists engaged on marine subjects. The Light-house board and Life-saving service will make a full display of their apparatus.

Model of Zuñi.—An accurate model of the pueblo of Zuñi has recently been completed for the Bureau of ethnology under the superintendence of Mr. Victor Mindeleff. It is about 19 × 11 feet square, and shows the details of the houses and streets. The data for its construction were derived from actual surveys.

Archeological fraud.—A remarkable archeological fraud in the form of a stone idol arrived at the museum a few days ago. It had been advertised as probably the 'god of all the gods.' It has the beak of a bird, the forehead of a lizard, the wings of a beetle, and the abdomen of a grasshopper. The feet are six in number,—four like those of a gopher tortoise, two like those of a seal. The general color is brown, relieved here and there with lighter spots and streaks. The length of the object is about 2½ feet, the width about 6 inches.

Department of agriculture.

Extension of statistical division.—The scope of the statistical division was last year enlarged to include in its monthly reports statements showing the through rates of transportation by railroad and steamboat companies, on all the principal routes of the country, for the principal agricultural products.

A European agency was also established for the collection of statistics indicating the prospective European demand for American grains and meats. The agency is in charge of Mr. Edmund J. Moffatt, and its headquarters are at the office of the consul-general at London. The results of this widening of the scope of the statistical division have already proved highly satisfactory.

Meeting of agriculturists. — Commissioner Loring has issued another call for a series of meetings of prominent agriculturists at the department at Washington, commencing Jan. 23. The subjects announced for discussion were: agricultural colleges and their work, the animal industries of the country, and the cotton crop and its relation to agriculture in the cotton States.

National experiment stations. — A bill is now before Congress, introduced by Representative Carpenter of Iowa, providing for the establishment of national experiment stations in connection with the agricultural colleges of the different States, and under the control of the department. An annual appropriation of \$15,000 for each station is provided for, to be expended in salaries and the expenses of experiments. The bill has received the indorsement of Commissioner Loring, and is considered the soundest and most practical scheme in the way of agricultural legislation which has been brought before Congress since the agricultural college land grant of 1862. Small as the appropriation is, it will give a much-needed stimulus to the work of some of our smaller agricultural colleges, especially in the south.

Sorghum. — Since 1877, the efforts of the department to prove the possibility of profitable sugar-making from sorghum have attracted much attention throughout the country, and been variously commented on by the agricultural press. Some time since, the results of the investigations of Professor Collier, chemist of the department, were submitted to the National academy of sciences for an opinion as to their value. The report of the committee of the academy, first made, was withdrawn for revision on the 21st of last July, and returned to the commissioner on the 15th of November, when an abstract was given to the daily press. The entire report will be published as a special document. Realizing the fact that the results of the mill-work at Washington during the two previous years had been discouraging, Dr. Loring devoted the congressional appropriation for the continuance of experiments in 1883 to the remuneration of the successful manufacturers throughout the country, for operations conducted under his direction. In this way a great amount of practical experience from different sections has been obtained, and will soon be published in a special report. This course was heartily indorsed by the Cane-growers' association of the Mississippi valley at its recent annual meeting in St. Louis, and before which the commissioner delivered an address, in which he reviewed the whole subject of sorghum sugar-making, and urged that the effort to establish so important an industry as the production of sugar in the Northern States should be conducted with the same judgment, patience, and perseverance as have been applied to the great industries already established.

PUBLIC AND PRIVATE INSTITUTIONS.

Museum of comparative zoology, Cambridge, Mass.

Selections from embryological monographs. — One of the last numbers of the memoirs of the museum contains the first of a series of Selections from embryological monographs, compiled by Alexander Agassiz, Walter Faxon, and E. L. Mark. The

object of these selections is to give to the student in an easily accessible form a more or less complete iconography of the embryology of each group of the animal kingdom. This selection is not intended as a handbook, but rather as an atlas to accompany any general work on the subject. The plates will be issued in parts, each part covering a somewhat limited field. The quarto illustrations are accompanied by a carefully prepared explanation of the plates, and by a bibliography in octavo, to be made as complete as possible.

The first part, Crustacea, is by Mr. Faxon. It consists of fourteen plates and twenty-eight pages of explanatory matter. The source from which each figure is taken is invariably indicated, while a general heading for the principal groups treated gives a list of the authors whose figures have been copied. A number of unpublished original drawings by Mr. Agassiz have been incorporated wherever they supplement published material.

We may form some idea of the activity of the different nations in the field of morphology by stating that these illustrations were copied from the memoirs of nine Germans, five Americans, four Russians and as many English, of three Scandinavians, two Belgians, one Dutchman, and one Frenchman; the importance of the contributions is also fairly represented in the above enumeration.

Dr. A. S. Packard, jun., and Dr. J. W. Fewkes, will assist the editors of the 'selections' in the preparation of the Insects and Acalephae. The second number of the bibliography, Echinodermata, by Alexander Agassiz, has been issued as No. 2 of vol. x. of the museum bulletin; the illustrations of that part will be published during the coming summer.

Academy of natural sciences, Philadelphia, Penn.

The Vaux gift. — Arrangements are being made for the reception and arrangement of the fine collections of minerals and antiquities belonging to the late William S. Vaux. The gift includes a sufficient endowment to provide for the appointment of a special curator and for the annual increase of both collections by purchase of specimens.

Professor A. Heilprin began a course of twenty-five lectures on physiography and paleontology, on Jan. 12, to be given on the successive Tuesdays and Fridays of each week. The lectures involve the consideration of the following general subjects: The rock masses of the earth's crust; present and past climates; wind and currents; geographical and geological distribution of animals; and the succession of life on the globe.

At the close of Professor Heilprin's lectures, Professor H. Carvill Lewis will deliver a course on mineralogy and lithology, a large portion of which will consist of a series of field-lectures upon the mineralogy and lithology of Philadelphia and vicinity, of which a fuller account will be given in a future issue. Similar courses delivered last year by Professors Heilprin and Lewis were well attended, principally by teachers in the colleges and higher schools of the city.

NOTES AND NEWS.

— A telegram from London, Jan. 17, informs us that Mr. George H. Darwin has been elected professor of astronomy and experimental philosophy in the University of Cambridge. Professor Darwin is a son of the late Charles R. Darwin, and, until very recently, has been a Fellow of Trinity College. Al-

though a young man, he has been for several years a Fellow of the Royal society, and has attained a world-wide reputation for his investigations in celestial mechanics.

Professor Darwin's more important papers are: On the influence of geological changes in the earth's axis of rotation;—On the bodily tides of viscous and semi-elastic spheroids, etc.;—On the precession of a viscous spheroid, etc.;—Problems connected with the tides of a viscous spheroid;—On the tidal friction of a planet attended by several satellites, etc.;—On the secular changes in the elements of the orbit of a satellite, etc.;—On the stresses caused in the interior of the earth by the weight of continents and mountains. These papers are all contained in the Philosophical transactions of the Royal society between the years 1876–82. Professor Darwin has also published many other papers on the above and cognate subjects, which are to be found in various scientific publications. One of his latest papers is the Report of the British association committee appointed for the measurement of the lunar disturbance of gravity; and on another page of this issue will be found a full analysis of a still more recent essay.

Professor Darwin's friends, both in America and England, must feel that the University of Cambridge has honored itself as much as it has honored him in appointing him to this high position, as his scientific ability and acquirements in the particular line of work to which he has chosen to devote himself rank second to those of no one living. American students who have had the pleasure of meeting Professor Darwin in Cambridge cannot help feeling a decided pleasure in hearing of his elevation when they recall his uniform kindness and generous hospitality.

—We regret to announce the death of the Rev. Titus Coan, whose contributions to our knowledge of the volcanic outbreaks of Mauna Loa are well known. Born at Killingworth, Conn., in 1801, he was sent in 1833 by the American board of commissioners for foreign missions to explore Patagonia, and, in the next year, as a missionary to the Hawaiian Islands, where for nearly half a century he has been a faithful and beloved pastor. In his mission district on Hawaii is the largest active volcano in the world; and its two craters, Mokuaweoweo and Kilauea, were carefully watched and studied by him. The wild path of his quarterly tours led along the brink of Kilauea, and no man knew more of its condition than he. From the flanks of Mauna Loa came many important lava-flows; the latest, in 1881, after a course of more than thirty miles, came within a mile of his doorway; earthquakes rocked his house in Hilo; seaquake waves swept his shores; landslides destroyed his people and their cattle. In the midst of these phenomena he carefully observed and recorded; and his reports published in various scientific periodicals (especially in the American journal of science), as

well as in the Missionary herald, contain most vivid and accurate accounts of Hawaiian volcanic action. Every explorer of these islands has been welcomed to his beautiful home, and greatly assisted; and all have parted from him as from a wise and good friend they hoped again to meet. Healthful all his life, he died of old age on the 1st of last December. His Adventures in Patagonia, published a few years since, and his Life in Hawaii, 1835–1881, contain the modest story of his life, at once wise, useful, philanthropic, and religious. A memorial meeting was to be held at Hilo, on his birthday, Feb. 1.

—The annual election of the Academy of natural sciences of Philadelphia was held on Dec. 26 last, and resulted as follows: President, Jos. Leidy, M.D.; Vice-Presidents, Thomas Meehan and Rev. Henry C. McCook; Recording Secretary and Librarian, Edw. J. Nolan, M.D.; Corresponding Secretary, George H. Horn, M.D.; Treasurer, William C. Henszey; Curators, Jos. Leidy, M.D., Charles F. Parker, Jacob Binder, and W. S. W. Ruschenberger, M.D.; Councillors to serve three years, Thomas A. Robinson, Edw. Potts, Isaac C. Martindale, Theo. D. Rand.

The annual reports of the officers and sections, which were read, indicated that the society, during the past year, has been in a condition of unusual prosperity.

—The Anthropological society of Washington held its annual election Jan. 16, with the following result: President, Col. Garrick Mallery, U.S.A.; Vice-presidents, Dr. Robert Fletcher, President J. C. Welling, Major J. W. Powell, and Professor Otis T. Mason; General Secretary, Dr. W. J. Hoffman; Corresponding Secretary, Col. F. A. Seely; Treasurer, Professor J. Howard Gore; Curator, Col. C. C. Royce; Council at large, Professor L. F. Ward, Mr. G. K. Gilbert, Dr. A. F. A. King, Professor E. A. Fay, Mr. H. W. Henshaw, and Mr. David Hutcheson. Major Powell retires from the presidency after four years service.

—At its general meeting, Jan. 6, the Brooklyn entomological society elected the Rev. G. D. Hulst, president; F. G. Schaupp, secretary; Charles Fuchs, treasurer; and J. B. Smith, curator.

—The young folks' course of four scientific lectures, given in Washington at the National museum, under the auspices of the biological and anthropological societies, was successfully brought to a conclusion on Jan. 6. The attendance throughout was good. It was the first course of the kind attempted in Washington for many years.

The second course of free Saturday lectures, inaugurated last year under the same auspices, was opened on the 13th inst. Twelve lectures will be given. The schedule for the first half of the course is as follows:—

Jan. 13, Capt. Clarence E. Dutton U. S. A., On rivers; Jan. 20, Professor Otis T. Mason, The races of men; Jan. 27, Mr. George Kennan, Mountains

and mountaineers of the Caucasus; Feb. 3, Dr. D. Webster Prentiss, Mesmerism in animals, with experiments; Feb. 10, Professor Theodore Gill, Mythical animals; Feb. 17, Dr. John S. Billings, U.S.A., Germs and epidemics.

— At the meeting of the Biological society of Washington, held Jan. 19, an address was given by the retiring president, Professor Theodore Gill, on the Principles of zoögeography.

— The Association of Ohio Colleges, during its meeting at Wooster, Dec. 27, formally adopted the resolutions of the American association for the advancement of science and the American philological association, concerning the degrees of S.D. and Ph.D. Henceforth the sixteen colleges comprising the association are in honor bound not to confer either degree, except upon examination.

— Diffuse but entertaining notes on the habits of *Lepus sylvaticus* are given by Rev. Samuel Lockwood in the December number of the American Naturalist.

RECENT BOOKS AND PAMPHLETS.

Ballard, R. The solution of the pyramid problem, or Pyramid discoveries; with a new theory as to their ancient use. N.Y., 1882. 8°.

Beal, W. J. The new botany: a lecture on the best method of teaching the science. 2d ed., revised. Phila., Marot. 1882. 16 p. 8°.

Beard, George M. Herbert Spencer on American nervousness: a scientific coincidence. N.Y., Putnam. 1883. 17 p. 8°.

Brunner von Wattenwyl, Carl. Prodrömus der europäischen orthopteren. Leipzig, Engelmann. 1882. 32 + 466 p., 11 pl., map. 8°.

Cambridge—Peabody museum of American archæology and ethnology. Fifteenth annual report of the trustees [and curator]. Cambridge, Trustees. 1882. [106 p.] 8°. Forms vol. iii., No. 2, of the reports.

Comstock, J. H. Report on insects for the year 1881; with illustrations. Wash., Government. 1882. 22 p., [7] pl. 8°.

Dames, W., and Kayser, E., editors. Palæontologische abhandlungen. 1er bd. heft. 1. Struckmann, C. Neue beiträge zur kenntniss des oberen Jura und der waeldenbildungen der umgegend von Hannover.) Berlin, 1882. 4 pl. 4°.

Decante, E. Tables du cadran solaire azimutal pour tous les points situés entre les cercles polaires. Variation automatique, détermination instantanée du relèvement vrai, contrôle de la route. 2 vol. Paris. 1882. 8°.

Fletcher, Robert. On prehistoric trephining and cranial amulets. Wash., Government. 1882. 32 p., 9 pl. 4°.

Frazer, Persifor. Mémoire sur la géologie de la partie sud-est de la Pennsylvanie. Thèse présentée à la faculté des sciences de Lille. Lille, Imp. Sie-Horemans. 1882. 179 p., 4 pl. 4°.

Geikie, Archibald. Text-book of geology. N.Y. Macmillan. 1882. 11 + 971 p. ill. 8°.

Harris, Edward Doubleday. Memoir of Thaddeus William Harris, M.D. Cambridge, Wilson. 14 p., chart. 8°.

Hoffer, E. Die hummeln Steiermarks. Lebensgeschichte und beschreibung derselben. i. hälfte. Graz. 1882. 8°. Plates.

International exhibition of electricity, Paris, 1881. Report of the sub-commission [Barker and others] on incandescent lamps. N.Y., Burgoyne pr. 1882. 28 p. 8°.

Laflamme, l'abbé J. C. K. Le Canada d'autrefois; esquisse géologique. Conférence donnée à l'Institut canadien de Québec, durant l'hiver de 1882. n.p. 23 p. 8°.

Loew, O., u. Bokorny, T. Die chemische kraft- quelle im lebenden protoplasma; theoretisch begründet und experimentell nachgewiesen. München. 1882. 8°.

London—Royal geographical society. Supplementary papers. Vol. i. pt. 1. (Travels and researches in western China; by E. C. Baber.) London. 1882. 8°.

Mass.—Commissioners on inland fisheries. Seventeenth annual report for 1882. Boston, State. 1883. 58 p. 8°.

Maxwell, James Clerk. Life, with selections from his correspondence and occasional writings, and a sketch of his contributions to science; by Lewis Campbell and W. Garnett. N.Y., Macmillan. 1882. 16 + 662 p., 3 portr. & pl. 8°.

Minchin, G. M. Uniplanar kinematics of solids and fluids, with applications to the distribution and flow of electricity. N.Y., Macmillan. 1882. 8 + 266 p. 12°.

Princeton—College of New Jersey. Preliminary report upon the Princeton scientific expedition of 1882; by W. B. Scott and W. F. Magie. Princeton, Robinson, pr. 1882. 8 p. 8°.

Riley, C. V. Report of the entomologist of the Department of agriculture for the year ending June, 1882. Wash., Government. 1882. 167 p., 20 pl. 8°.

Scientific and literary gossip. Vol. 1, nos. 1-3. Boston, Cassino. 1882-1883. 16 p.m. 8°.

Searles, W. H. Field engineering; a handbook of the theory and practice of railway surveying, location and construction. 4th ed. N.Y., Wiley. 1883. 12°.

Searles, W. H. The railroad spiral: the theory of the compound transition curve reduced to practical formulæ and rules for application in field-work. N.Y., Wiley. 1883. 12°.

Southwick, A. P. Question-book of botany with notes, queries, etc. Syracuse, Bardeen. 1882. 40 p. 16°.

Spencer, Herbert. Herbert Spencer on the Americans and the Americans on Herbert Spencer: a full report of his interview and of the proceedings at the farewell banquet of Nov. 9, 1882. N.Y., Appleton. 1883. 96 p. 12°.

Studer's popular ornithology: the birds of N. America, drawn and colored from nature; by T. Jasper. N.Y., Studer. 1883. 182 p., 119 pl. f°.

Taylor, W. B. Physics and occult qualities. An address before the philosophical society of Washington, Dec. 2, 1882. Washington, Judd and Detweiler, pr. 1882. 50 p. 8°.

U. S.—Department of agriculture. Report of the commissioner of agriculture for the years 1881 and 1882. Wash., Government. 1882. 704 p., 84 pl. 8°.

Washington—Anthropological society. Transactions. Vol. 1, Feb. 10, 1879-Jan. 17, 1882. Wash., Society. 1882. 142 p. 8°.

Washington—Smithsonian institution. Catalogue of publications of the Smithsonian institution (1846-1882), with an alphabetical index of articles in the Smithsonian contributions to knowledge, Miscellaneous collections, Annual reports, Bulletins and proceedings of the U. S. national museum and Report of the bureau of ethnology; by William J. Rhees. Wash., Institution. 1882. 328 p. 8°.